UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF NEW YORK

PLASMA PHYSICS CORPORATION and SOLAR PHYSICS CORPORATION, Plaintiffs, v. AU OPTRONICS CORPORATION and AU OPTRONICS CORPORATION AMERICA, Defendants.	)	Civil Action No. 2:08-cv-1627-LDW-WDW
PLASMA PHYSICS CORPORATION and SOLAR PHYSICS CORPORATION, Plaintiffs, v. CHI MEI OPTOELECTRONICS CORP. and CHI MEI OPTOELECTRONICS USA INC., Defendants.	)	Civil Action No. 2:08-cv-1628-LDW-WDW
PLASMA PHYSICS CORPORATION and SOLAR PHYSICS CORPORATION, Plaintiffs, v. INNOLUX DISPLAY CORPORATION and INNOLUX CORPORATION AMERICA, Defendants.	)	Civil Action No. 2:08-cv-1629-LDW-WDW

REPORT AND RECOMMENDATION
OF THE SPECIAL MASTER CONCERNING CLAIM CONSTRUCTION

I. INTRODUCTION

Plaintiffs, Plasma Physics Corporation and Solar Physics Corporation (collectively "PPC"), filed their patent infringement lawsuit against Defendants, AU Optronics Corporation America and AU Optronics Corporation ("AUO"), Chi Mei Optoelectronics Corp. and Chi Mei Optoelectronics USA Inc. ("CMO"), and Innolux Corporation and Innolux Display Corporation ("Innolux") on April 18, 2008. PPC has alleged in its complaint, inter alia, that Defendants infringe their U.S. Patents Nos. 5,470,784 (the " '784 Patent"), 5,543,634 (the " '634 Patent"), and 6,245,648 (the " '648 Patent") (collectively, the "patents-in-suit").

Pursuant to Order, entered March 17, 2009, Robert J. Rando, Esq., was appointed as a Special Master (the "Special Master" or "Special Master Rando") to hear and report his recommendations on the parties' claim construction dispute. Pursuant to agreement among the parties, submission of opening and opposition briefs was completed on March 27, 2009. A Markman Claim Construction Hearing ("Markman Hearing") was held on July 21, 22 & 23, 2009.

The initial disputed terms included 26 claim terms from the three patents-in-suit. On July 6, 2009, the Court entered an order for the settlement and voluntary dismissal of the lawsuit between PPC and Innolux, with prejudice. During the Markman Hearing, the then remaining parties reached agreement on seven previously disputed terms, leaving 19 terms still in dispute. On November 4, 2009, the Court entered an order for the settlement and voluntary dismissal of the lawsuit between PPC and AUO, with prejudice. Consequently, there are seven disputed terms between the remaining parties, PPC and CMO. These seven disputed terms are the subject of the present Special Master's Report and Recommendation on Claim Construction.

II. BACKGROUND

A. THE PATENTS

The patents-in-suit are directed to inventions covering manufacturing processes for forming semiconductor devices (the '784 Patent and the '648 Patent) and for semiconductor devices (the '634 Patent). The '784 Patent is entitled: "Method of Forming Semiconducting Materials and Barriers Using a Multiple Chamber Arrangement." The '634 Patent is entitled: "Method of Forming Semiconductor Materials and Barriers." The '648 Patent is entitled: "Method of Forming Semiconducting Materials and Barriers."

The patents-in-suit each claim priority through several divisional and continuation applications to the same original application filed on December 5, 1977, which later issued as U.S. Patent No. 4,226,897 (now expired). The patents-in-suit each share substantially similar specifications and drawings of said original application.

B. THE PATENTED TECHNOLOGY

As disclosed in the patents-in-suit, fabrication of silicon semiconductor devices involves numerous steps including the depositing of thin films on a device or substrate. See "Plaintiffs' Memorandum of Law Regarding Claim Construction" (hereinafter "PPC's Opening Br.") at 2.[1] In silicon semiconductor devices, such as integrated circuits ("ICs"), the substrate is a silicon

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[1] All citations to the Parties' briefs (including the citations contained within the briefs), and attached exhibits, will be as follows:
"Plaintiffs' Memorandum of Law Regarding Claim Construction" – "PPC's Opening Br. at __."
"Plaintiffs' Opposing Memorandum Regarding Claim Construction" – "PPC's Opp. Br. at __."
"Declaration of Jennifer Cozeolino in Support of Plaintiffs' Memorandum of Law Regarding Claim Construction" – "PPC's Exh. __."
"Defendants' Claim Construction Brief for U.S. Patent Nos. 5,470,784, 6,245,648 and 5,543,634" – "CMO's Opening Br. at __."
"Defendants' Opposition Claim Construction Brief" – "CMO's Opp. Br. at __."
"Exhibits to Defendants' Claim Construction Brief for U.S. Patent Nos. 5,470,784, 6,245,648 and 5,543,634" – "CMO's Exh. ___."

All citations to the Transcript for the Markman Claim Construction Hearing of July 20, 21 & 22, 2009, will be as follows: "Markman Hr'g Tr. ___: ___."

wafer. For thin film transistors ("TFTs"), used in liquid crystal displays ("LCDs"), the substrate is a large piece of glass. Id. Such thin films include silicon oxide dielectric layers that provide insulation for the interconnects, silicon nitride passivation layers, and barrier layers utilized in the operation of solar cells and in the operation of devices such as the TFTs used in LCD displays. Id.

One process for depositing thin films on substrates is known as plasma enhanced chemical vapor deposition ("PECVD"). Id. at 3. In this process, gases are introduced at sub-atmospheric pressure into an evacuated chamber or enclosure from an external source and subjected to an electrical field. Id. The energy created in the electric field ionizes said gases into reactive chemical species. Id. The reaction of the ionized gases with the surface of a substrate causes a thin film to be deposited on the surface of said substrate. (PPC's Opening Br. at 3). This deposition functions similarly (although by a different process) to the formation of a thin film of ice on an automobile windshield during a cold morning. Id. Like the water vapor from the air that condenses and freezes on the windshield, the ionized gases react and form a thin film that is deposited on to a substrate. Id.

According to PPC, the patents-in-suit generally represent two distinct innovations. One is in the field of PECVD processing, and the other is in the manufactured devices themselves. Id. Said first innovation, as described and claimed in the '784 Patent and '648 Patent, discloses methods that make it possible to deposit very thin films of high uniformity and quality with high throughput by utilizing multiple process chambers operating in a pipelined or parallel fashion. Id. Said second innovation, as described and claimed in the '634 Patent, is a device having a barrier layer that can be useful in semiconductor applications, such as the TFTs (often several million layers in a single device) that are required to control the individual pixels in an LCD. Id.

C. PRIOR LITIGATION ISSUES INVOLVING PPC

PPC has asserted two of the three patents-in-suit, the '784 Patent and the '648 Patent, against other non-parties in cases filed prior to the present litigation.[2] The claim construction issues were fully briefed in those cases and, pursuant to this Court's direction, a special master was appointed (Special Master Filardi) to hear and report his recommendations on claim construction disputes between those other parties.[3] He filed his Report and Recommendation with the Court on June 2, 2004 ("Filardi R & R").

The parties in the prior litigations filed various motions concerning, and objections to, the Filardi R & R. (See PPC Opp. Br. at 2). While the motions were pending, and prior to resolution of the objections to the Filardi R & R, the parties in those cases resolved and settled the lawsuits. (See id.) As such, there was no final claim construction order and the parties agree that the Filardi R & R has no binding or preclusive effect on the present lawsuit and parties thereto. Hence, Special Master Rando informed the parties that he would not consider the Filardi R & R for purposes of his report and recommendation. However, to the extent the parties presented positions relying upon or refuting the findings in the Filardi R & R, concerning any of the same disputed terms that are disputed in the present litigation, the Special Master and the parties agreed that it would be treated as argument adopted and presented by the respective party.

III. GUIDING LEGAL PRINCIPLES

In 1996, the Supreme Court issued its decision concerning patent claim construction in Markman v. Westview Instruments, Inc., 517 U.S. 370 (1996). In its Opinion, the Supreme Court

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[2] Plasma Physics v. Agilent Techs., Civ. No. 02-3456; Plasma Physics v. Micron Tech., Civ. No. 02-3457; Plasma Physics v. Nat'l Semiconductor Corp., Civ. No. 02-3459; Plasma Physics v. LSI Logic Corp., Civ. No. 02-3462; Plasma Physics v. IBM, Civ. No. 02-3463; Plasma Physics v. STMicroelectronics, Inc., Civ. No. 02-3475; and Plasma Physics v. Analog Devices, Inc., Civ. No. 02-3484.

[3] Special Master Filardi's report was also accepted, by stipulation of the parties, for the report and recommendation regarding claim construction in *Plasma Physics v. IBM*, Civ. No. 02-3463; *Plasma Physics v. STMicroelectronics, Inc.*, Civ. No. 02-3475; and *Plasma Physics v. Analog Devices, Inc.*, Civ. No. 02-3484. The parties in those cases filed objections to Special Master Filardi's report with the Court.

affirmed the en banc decision of the Federal Circuit, in Markman v. Westview Instruments, Inc., 52 F.3d 967 (Fed. Cir. 1995), declaring that patent claim construction is a pure question of law to be resolved by the court. Markman v. Westview Instruments, Inc., 517 U.S. 370, 372 (1996). Patent claim construction is the interpretation of the words in a patent's claims, i.e., the actual meaning of the words describing the boundaries of the patented invention or what the inventor intends as his or her exclusive domain for the life of the patent. See Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005). Proper claim construction is necessary to determine whether a claim is valid, enforceable, and infringed. See Lemelson v. United States, 752 F.2d 1538, 1549 (Fed. Cir. 1985).

The Supreme Court declared the legal standard for patent claim construction but did not provide specific guidelines for its procedure. See Markman v. Westview Instruments, Inc., 517 U.S. 370 (1996). However, the United States Court of Appeals for the Federal Circuit has articulated the appropriate methodology applicable to patent claim construction. See Phillips, 415 F.3d at 1315-19 (Fed. Cir. 2005). Following the approved claim construction methodology, the district court determines the meaning and scope of the claims in order to ascertain the acquired meaning of the claim language. See id. at 1317.

A. THE INTRINSIC RECORD

In construing patent claims, the Court first looks to the intrinsic record which consists of: the claim language; the patent specification; and, the patent's prosecution history. Phillips, 415 F.3d at 1312. Such intrinsic evidence constitutes the public record of the patentee's claim. Id. at 1319. Intrinsic evidence is the most important resource in determining the operative meaning of disputed claim language, and usually will resolve any ambiguity concerning that language. Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582-83 (Fed. Cir. 1996). Indeed, "in those

cases where the public record unambiguously describes the scope of the patented invention, reliance on any extrinsic evidence is improper." Id. at 1583.

1. The Claim Language

The claims of a patent define the boundaries of the patented invention, and the public is entitled to rely upon the claims to determine what does or does not constitute infringing activity. See, e.g., London v. Carson Pirie Scott & Co., 946 F.2d 1534, 1538 (Fed. Cir. 1991) (finding "no infringement as a matter of law" if claim limitation is totally missing from accused device). The Court interprets patent claims as a matter of law to "determine how a person of experience in the field of [the] invention would, upon reading the patent documents, understand the words used to define the invention." Toro Co. v. White Consolidated Indus., Inc., 199 F.3d 1295, 1299 (Fed. Cir. 1999).

2. The Specification

The patent specification, i.e., the written description and drawings, describe the manner and process of making and using the invention so that any person skilled in the patent's art may utilize it. Vitronics, 90 F.3d at 1582. The specification is regarded as the "single best guide to the meaning of a disputed term." Phillips, 415 F.3d at 1315 (quoting Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996)). Claims are construed in light of the entire specification. See Phillips, 415 F.3d at 1315-16. The construction relies upon the specification's characterization of the claimed invention. See id. at 1316.

3. The Prosecution History

The prosecution history of a patent comprises "the complete record of all the proceedings before the Patent and Trademark Office, including any express representations made by the applicant regarding the scope of the claims. As such, the record before the Patent and Trademark Office is often of critical significance in determining the meaning of the claims." Vitronics, 90

F.3d at 1582; see also ZMI Corp v. Cardiac Resuscitator Corp., 844 F.2d 1576, 1580 (Fed. Cir. 1988) (stating that prosecution history must be reviewed to interpret disputed claims). In reviewing the prosecution history, the Court also examines the prior art considered by the United States Patent and Trademark Office (the "PTO" or "Patent Office") to assess what the claims do not cover. See, e.g., Watts v. XL Sys., Inc., 232 F.3d 877, 883 (Fed. Cir. 2000) (limiting claim interpretation based on arguments made to Patent Office with respect to prior art reference); ZMI Corp., 844 F.2d at 1580-81 (limiting claim interpretation based on arguments made to Patent Office distinguishing application from prior art references). "The prosecution history (or file wrapper) limits the interpretation of claims so as to exclude any interpretation that may have been disclaimed or disavowed during prosecution in order to obtain claim allowance." Standard Oil Co. v. American Cyanamid Co., 774 F.2d 448, 452 (Fed. Cir. 1985); see also Wang Labs., Inc. v. America Online, Inc., 197 F.3d 1377, 1384 (Fed. Cir. 1999) (finding patentee limited claims by arguments made during the prosecution of the patent's parent application).

The arguments and amendments made during prosecution of a patent application must be examined to determine the meaning of terms in the claims. See Southwall Techs., Inc. v. Cardinal IG Co., 54 F.3d 1570, 1576 (Fed. Cir. 1995) (affirming district court's limiting of claim to a one-step process rather than two-step process specifically disclaimed in the patent's prosecution history). The prosecution history limits the interpretation of claim terms so as to exclude any interpretation that was disclaimed during prosecution. Id. Explicit statements made by a patent applicant during prosecution to distinguish a claimed invention over prior art may serve to narrow the scope of the claim. See Spectrum Int'l, Inc. v. Sterilite Corp., 164 F.3d 1372, 1378 (Fed. Cir. 1998) (narrowing claim during reexam to sustain patentability of claims over prior art precludes patentee from later arguing the disclaimed matter is infringed). Explicit arguments made during prosecution to overcome prior art can lead to narrow claim

interpretations because "the public has a right to rely on such definitive statements made during prosecution." Digital Biometrics, Inc. v. Identix, Inc., 149 F.3d 1335, 1347 (Fed. Cir. 1998) (highlighting importance of notice function of patent prosecution process as reflected by patent statute).

B. EXTRINSIC EVIDENCE

Extrinsic evidence, i.e., all evidence external to the patent and prosecution history, (e.g., inventor testimony, dictionaries, and learned treatises) may be used by the court to help understand the disputed limitation. See Novartis Pharms. Corp. v. Abbott Labs., 375 F.3d 1328, 1335 (Fed. Cir. 2004) (describing the proper role of extrinsic evidence). Extrinsic evidence may not be used to vary, contradict, expand, or limit the claim language from how it is defined, even by implication, in the specification or file history. Id. Dictionaries and comparable sources are often useful in understanding the commonly used meanings of words, and judges are free to consult the dictionary so long as the dictionary definition does not contradict any definition found in the patent document. See Phillips v. AWH Corp., 415 F.3d 1303, 1322-23 (Fed. Cir. 2005). While a court may use extrinsic evidence, it is generally less reliable than the intrinsic record in determining the meaning of claim language, and, as such, "is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence." Id. at 1319.

1. Dictionaries And Technical Treatises

Technical treatises and dictionaries are categorized as extrinsic evidence, since they do not form a part of the intrinsic record, however they are distinct from other extrinsic evidence. See Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1584 n.6 (Fed. Cir. 1996). Judges can freely consult these resources to better understand the underlying technology and may also rely

on dictionary definitions when construing claim terms, as long as the dictionary definition does not contradict the intrinsic record. Id.

2. Prior Art

Courts may also rely on prior art whether or not cited in the specification or prosecution history. See Vitronics , 90 F.3d 1576 at 1584. Prior art may help demonstrate the understanding of the disputed term by those skilled in the art. Id. However, reliance on such evidence is improper, when the disputed terms can be understood from the intrinsic record. Id. Also, as with other types of extrinsic evidence, it may not be used to vary or contradict the disputed claim term construction adduced from the intrinsic record. See Apex Inc. v. Raritan Computer, Inc., 325 F.3d 1364, 1371 (Fed. Cir. 2003).

3. Experts And Expert Testimony

A district court may rely on expert testimony solely to help it understand the underlying technology. See Altiris, Inc. v. Symantec Corp., 318 F.3d 1363, 1369 (Fed. Cir. 2003) (relying on expert testimony to understand the technology is appropriate in claim construction). Such testimony may only be relied upon if the intrinsic evidence is insufficient to enable a court to construe disputed claim terms. See Vitronics , 90 F.3d 1576 at 1584. However, even under those circumstances, resort to other forms of extrinsic evidence, (e.g., dictionaries, treatises, prior art) is preferred. Id. These other forms of extrinsic evidence are considered to be more objective and reliable than expert testimony since they are available to the public prior to the litigation. Id.

C. THE CLAIM INTERPRETATION PROCESS

When determining the meaning of a disputed term, the first step is to examine the claim language itself. Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996). Where the claim language is clear on its face and susceptible of a clear and unambiguous plain meaning and scope, and in the absence in the intrinsic record of any clear deviation or

contradiction, or clear intent by the inventor to be his or her own lexicographer, the inquiry need go no further. See Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1331 (Fed. Cir. 2001) (intrinsic record analyzed for deviation from plain meaning for claim language that is clear on its face). Otherwise, one must turn to the remainder of the patent (i.e., the language in all of the remaining patent claims (asserted and non-asserted) and the patent specification and abstract) to investigate the context of its usage and scope. See id.; Telemac Cellular Corp. v. Topp Telecom, Inc., 247 F.3d 1316, 1326 (Fed. Cir. 2001) (relying on written description to interpret disputed claim term which did not have a clear and ordinary meaning). In other words, the remainder of the "four corners" of the patent document. See Interactive Gift, 256 F.3d at 1331; Telemac Cellular, 247 F.3d at 1326.

An additional component of the intrinsic record is the patent prosecution history or the "file wrapper." Phillips, 415 F.3d at 1317. The interplay between the prosecution history and the four corners component of the intrinsic record is one of limitation or amplification of the claimed invention. See id. As such, and because it can often contradict the language of description contained in the four corners component, the prosecution history component must be clear, unambiguous and unequivocal. See Honeywell Int'l, Inc. v. Universal Avionics Sys., 493 F.3d 1358, 1365 (Fed. Cir. 2007) (concluding arguments made during prosecution of patent-in-suit were ambiguous and therefore did not limit claim scope).

Where the prosecution history presents a clear, unambiguous and unequivocal disavowal of claimed patented subject matter, to overcome a prior art rejection, the prosecution history will be granted preclusive, estoppel or limitation power over a contrary meaning. See Omega Eng., Inc. v. Raytek Corp., 334 F.3d 1314, 1324-26 (Fed. Cir. 2003) (citing numerous cases refusing to apply prosecution history disclaimer where the asserted disclaimer is not clear and unmistakable). While overcoming a prior art rejection in itself may satisfy the rigid requirement

for prosecution history disclaimer or estoppel, it is by no means the exclusive application of the doctrine. See Ekchian v. Home Depot, Inc., 104 F.3d 1299, 1303-04 (Fed. Cir. 1977) (Information Disclosure Statement may be basis for estoppel). Prosecution history disclaimer or estoppel can be applied where the record provides clear, unambiguous and unequivocal evidence of disclaimed or expanded subject matter (provided that where there is "expansion" it is supported by the four corners component's patent specification). See, e.g., Intervet Am., Inc. v. Kee-Vet Labs., Inc., 887 F.2d 1050 (Fed. Cir. 1989) (claim language controls to afford patentee expanded claim coverage over erroneous remark made by prosecuting attorney during prosecution).

1. Ordinary And Customary Usage

The words of a claim "are generally given their ordinary and customary meaning." Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005); Vitronics, 90 F.3d at 1582; see also Toro Co. v. White Consol. Indus., Inc., 199 F.3d 1295, 1299 (Fed. Cir. 1999) (ordinary and customary meaning); Renishaw PLC v. Marposs Societa' per Azioni, 158 F.3d 1243, 1249 (Fed. Cir. 1998) (same). The ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention (i.e., as of the effective filing date of the patent application). See Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc., 381 F.3d 1111, 1116 (Fed. Cir. 2004) (court construes patent claim with meaning accorded to it by person of ordinary skill at time of the invention); Home Diagnostics, Inc. v. LifeScan, Inc., 381 F.3d 1352, 1358 (Fed. Cir. 2004) ("customary meaning" refers to customary meaning in the art).

How a person of ordinary skill in the art understands a claim term provides an objective baseline from which to start the claim interpretation process. Phillips, 415 F.3d at 1313; Innova, 381 F.3d at 1116. "That starting point is based on the well-settled understanding that inventors

are typically persons skilled in the field of the invention and that patents are addressed to and intended to be read by others of skill in the pertinent art." Phillips, 415 F.3d at 1313; see also Verve, LLC v. Crane Cams, Inc., 311 F.3d 1116, 1119 (Fed. Cir. 2002) (patent documents are meant to be "a concise statement for persons in the field"); In re Nelson, 280 F.2d 172, 181 (CCPA 1960) (descriptions in patents are not addressed to lawyers, judges or the public generally but to those skilled in the art).

2. Examine The Specification

The person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification. See Phillips, 415 F.3d at 1313. One cannot look at the ordinary meaning of the term in a vacuum. See Medrad, Inc. v. MRI Devices Corp., 401 F.3d 1313, 1318-19 (Fed. Cir. 2005). Rather, the ordinary meaning must be ascertained in the context of the written description and the prosecution history. Id.

3. Examine The Prosecution History

In addition to consulting the specification, a court "should also consider the patent's prosecution history, if it is in evidence." Markman v. Westview Instruments, Inc., 52 F.3d 967, 980 (Fed. Cir. 1995); see also Graham v. John Deere Co., 383 U.S. 1, 33 (1966) (invention is construed in the light of the claims and also with reference to the file wrapper or prosecution history). As part of the "intrinsic evidence," the prosecution history consists of the complete record of the proceedings before the Patent Office and includes the prior art cited during the examination of the patent. Autogiro Co. v. United States, 384 F.2d 391, 399 (Ct. Cl. 1967). Like the specification, the prosecution history provides evidence of how the PTO and the inventor understood the patent. See Lemelson v. Gen. Mills, Inc., 968 F.2d 1202, 1206 (Fed. Cir. 1992) (prosecution history provides insight into what the applicant originally claimed). Furthermore,

like the specification, the prosecution history was created by the patentee in attempting to explain and obtain the patent. Yet, because the prosecution history represents an ongoing negotiation between the PTO and the applicant, rather than the final product of that negotiation, it often lacks the clarity of the specification and thus is less useful for claim construction purposes. See Inverness Med. Switz. GmbH v. Warner Lambert Co., 309 F.3d 1373, 1380-82 (Fed. Cir. 2002) (the ambiguity of the prosecution history made it less relevant to claim construction); Athletic Alternatives, Inc. v. Prince Mfg., Inc., 73 F.3d 1573, 1580 (Fed. Cir. 1996) (the ambiguity of the prosecution history made it "unhelpful as an interpretive resource" for claim construction).

Nonetheless, the prosecution history can often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be construed. See Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582-83 (Fed. Cir. 1996); see also Chimie v. PPG Indus., Inc., 402 F.3d 1371, 1384 (Fed. Cir. 2005) (purpose of consulting prosecution history in construing claim is to "exclude any interpretation that was disclaimed during prosecution"); Southwall Techs., Inc. v. Cardinal IG Co., 54 F.3d 1570, 1576 (Fed. Cir. 1995) (prosecution history limits interpretation of claim terms to exclude any interpretation disclaimed during prosecution).

4. Reference To Dictionaries And Technical Treatises

Within the class of extrinsic evidence, the Federal Circuit has observed that dictionaries and treatises can be useful in claim construction. See Rexnord Corp. v. Laitram Corp., 274 F.3d 1336, 1344 (Fed. Cir. 2001) (relying on dictionary definition where specification was ambiguous). Technical dictionaries may assist a court "to better understand the underlying technology" and the way in which one of skill in the art might use the claim terms. See Vitronics,

90 F.3d at 1584 n.6. Because dictionaries, and especially technical dictionaries, endeavor to collect the accepted meanings of terms used in various fields of science and technology, those resources have been properly recognized as among the many tools that can assist the court in determining the meaning of particular terminology to those of skill in the art of the invention. See Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1325 (Fed. Cir. 2002) (recognizing that reliance on dictionaries and treatises to determine ordinary meaning may be appropriate).

5. Reference To Other Extrinsic Evidence

Extrinsic evidence in the form of expert testimony can be useful to a court for a variety of purposes, such as: to provide background on the technology at issue; to explain how an invention works; to ensure that the court's understanding of the technical aspects of the patent is consistent with that of a person of skill in the art; or to establish that a particular term in the patent or the prior art has a particular meaning in the pertinent field. See Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1308-09 (Fed. Cir. 1999); Key Pharms. v. Hercon Lab. Corp., 161 F.3d 709, 716 (Fed. Cir. 1998). However, conclusory, unsupported assertions by experts as to the definition of a claim term are not useful to a court. Similarly, a court should discount any expert testimony "that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent." Key Pharms., 161 F.3d at 716.

D. CLAIM INTERPRETATION STANDARDS AND GUIDELINES

The following, non-exhaustive list, outlines the several canons of patent claim construction, or presumptions, the courts rely upon in construing disputed patent terms:

1. Unique Lexicography

A patent applicant may be his or her own lexicographer. See Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996) (noting that a patentee may choose to be his own lexicographer and use words at variance with their ordinary meaning). The patent applicant may: create a new word; assign any meaning to a word regardless of the ordinary or customary usage of the word; and/or modify the word's ordinary or customary meaning. See Bell Atl. Network Servs. v. Covad Communs. Group, 262 F.3d 1258, 1268 (Fed. Cir. 2001) (recognizing power of inventor as own lexicographer). Any special meaning must appear with reasonable clarity and precision in the patent or the prosecution history. See Golight, Inc. v. Wal-Mart Stores, Inc., 355 F.3d 1327, 1332 (Fed. Cir. 2004) (stating that a patentee may define a term as his own lexicographer if he does so "with reasonable clarity, deliberateness, and precision"). If the special meaning is reasonably clear and precise then the word should be construed as having acquired that meaning. See Abbott Labs. v. Syntron Bioresearch, Inc., 334 F.3d 1343, 1354 (Fed. Cir. 2003) (finding that patentee's lexicography must appear "with reasonable clarity, deliberateness, and precision" before it can affect the claim).

2. No Importation Of Limitations From The Specification Into The Claims

One may not read a limitation into a claim from the written description. See Collegenet, Inc. v. Applyyourself, Inc., 418 F.3d 1225, 1231 (Fed. Cir. 2005) (court will not at any time import limitations from the specification into the claims); Phillips v. AWH Corp., 415 F.3d 1303, 1323 (Fed. Cir. 2005) (Federal Circuit has repeatedly warned against confining the claims to

specific embodiments); Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1326 (Fed. Cir. 2002) (limitations from specification "are not to be read into the claims"). The claims should not be confined only to the specification's disclosed embodiments of the invention. See Ventana Med. Sys., Inc. v. Biogenex Labs., Inc., 473 F.3d 1173, 1181-82 (Fed. Cir. 2006) (inventors are not required to claim specific preferred embodiment written in patent specification).

3. Prohibition Against Reading Out The Preferred Embodiment

Absent highly persuasive evidence, a construction should not be read to exclude the preferred embodiment. See Sandisk Corp. v. Memorex Prods., Inc., 415 F.3d 1278, 1285 (Fed. Cir. 2005) (district court's claim construction precluding preferred embodiment is wrong); C.R. Bard, Inc. v. U.S. Surgical Corp., 388 F.3d 858, 865 (Fed. Cir. 2004) (claim construction that reads out a preferred embodiment is rarely correct); Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1583 (Fed. Cir. 1996) (same).

4. Prohibition Against Limiting The Claims To The Preferred Embodiment

Claims should not be limited to the preferred embodiment disclosed in the specification. See Sandisk, 415 F.3d at 1286 (court will not limit claim terms to preferred embodiment); RF Delaware, Inc. v. Pacific Keystone Techs., Inc., 326 F.3d 1255, 1264 (Fed. Cir. 2003) (error for district court to read in "'most preferred embodiment'" as claim limitation).

5. Interpret Disputed Terms To Achieve Purpose Of The Invention

The meaning of a disputed claim term should ordinarily be construed to align with the purpose of the patented invention. See Markman v. Westview Instruments, Inc., 517 U.S. 370, 389 (1996) ("term can be defined only in a way that comports with the instrument as a whole"); Phillips v. AWH Corp., 415 F.3d 1303, 1316 (Fed. Cir. 2005) (correct construction "stays true" to claim language and "most naturally aligns" with patent's description); Merck & Co v. Teva

Pharms. USA, Inc., 347 F.3d 1367, 1371 (Fed. Cir. 2003) (claims must be construed consistent with specification); Reinshaw PLC v. Marposs Societa' Per Azioni, 158 F.3d 1243, 1250 (Fed. Cir. 1998) (persuasive claim construction "defines terms in the context of the whole patent").

6. Subject Matter Disclosed But Not Claimed Is Dedicated To The Public

Specific, non-generic, subject matter disclosed in the specification as an alternative to what is claimed, but not included in the claims, is considered to be dedicated to the public. See Pfizer, Inc. v. Teva Pharms. USA, Inc., 429 F.3d 1364, 1378-79 (Fed Cir. 2005) (unclaimed subject matter must be identified as alternative to a claim limitation to be deemed dedicated to public); PSC Computer Prods., Inc. v. Foxconn Int'l, 355 F.3d 1353, 1360 (Fed. Cir. 2004) (specific disclosure of molded plastic parts used in prior art devices as alternative to metal parts was dedicated to public where claim was only for metal parts).

7. Interpret Disputed Terms Consistent With Other Claims

Claim terms are presumed to be used consistently throughout the patent. See Research Plastics, Inc. v. Fed. Packaging Corp., 421 F.3d 1290, 1295 (Fed. Cir. 2005) (presumed consistent usage of claim terms throughout patent can illuminate meaning of the same term across different claims); Phillips, 415 F.3d at 1314 (same).

8. Claim Differentiation

Each patent claim is presumed to have a different scope. See RF Delaware, Inc. v. Pacific Keystone Techs., Inc., 326 F.3d 1255, 1263 (Fed. Cir. 2003) (each patent claim "presumptively different in scope"). A dependent claim is differentiated from the claim from which it depends and is generally construed to have a narrower scope. See Glaxo Group Ltd. v. Ranbaxy Pharms., Inc., 262 F.3d 1333, 1336 (Fed. Cir. 2001) ("[d]ependent claims are generally narrower in scope than the claims from which they depend"). Conversely, an independent claim is presumed to have a broader scope than its dependent claim. See Clearstream Wastewater Sys. v. Hydro-

Action, 206 F.3d 1440, 1446-47 (Fed. Cir. 2000) (claim differentiation prevents reading of limitations from narrower dependent claims into broader independent claims).

9. Steps Of A Method Claim Not Ordered Unless Recited In The Claim

Absent a recitation of order, or an order mandated by grammar or logic, the steps of a method claim are not construed to require a particular order. See Altiris, Inc. v. Symantec Corp., 318 F.3d 1363, 1369 (Fed. Cir. 2003) (absent clear or implied mandate in claim language or specification or resulting from the grammar and logic of method claim no order or sequence of steps is required); Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1342-44 (Fed. Cir. 2001) (same).

10. Interpret Disputed Term To Preserve Validity Of The Patent

If possible, where a claim is amenable to more than one construction, the claim should be construed to preserve its validity. Karsten Mfg. Corp. v. Cleveland Golf Co., 242 F.3d 1376, 1384 (Fed. Cir. 2001).

IV. THE DISPUTED TERMS[4]

A. "GLOW DISCHARGE"

The parties dispute the meaning of the claim term "Glow Discharge" as contained in the asserted claims in the patents-in-suit. (See PPC's Opening Br. at 20-23; PPC's Opp. Br. at 4-9; CMO's Opening Br. at 4-8; CMO's Opp. Br. at 1-4). The claim language from a representative claim for each asserted patent, with the disputed claim term highlighted in bold, is reprinted here: From the '648 patent:

> 5. A method of making a semiconductor device by forming a film on a substrate using a **glow discharge** maintained in a first vacuum chamber between first and

[4] A compilation of the disputed terms, the parties' respective proposed constructions, and the Special Master's recommended constructions, in Table form, is attached as Appendix 'A' hereto.

second electrodes positioned in a face-to-face relation, said first vacuum chamber being one of a plurality of vacuum chambers, said method comprising the steps of:

disposing said substrate on said first electrode;

introducing a gaseous film-forming material comprising silicon and hydrogen from an external source through said second electrode at sub-atmospheric pressure toward said substrate such that said gaseous material flows with a radially outward component of flow over said substrate while isolating said gaseous film-forming material in said first vacuum chamber from gases in any other chamber of said plurality of vacuum chambers; and,

maintaining between said electrodes a **glow discharge** that partially ionizes said gaseous material to form a film comprising silicon and hydrogen on said substrate.

(PPC Exh. B, the '648 Patent, at col. 9, lns. 37-56 (emphasis added)).

From the '634patent:

5. A semiconductor device comprising in combination:
a conductive electrode;
a layer of hydrogenated amorphous silicon; and,
a barrier layer comprising **glow discharge** deposited hydrogenated nitride of silicon and a metal oxide interposed between
said layer of hydrogenated amorphous silicon and said conductive layer.

(PPC Exh. C, the '634 Patent, at col. 10, lns. 12-20 (emphasis added)).

From the '784 patent:

21. A method of fabricating a semiconductor device comprising the steps of:
providing a first and second vacuum chambers;
providing an airlock in said first vacuum chamber;
disposing a substrate in said first vacuum chamber in a first gaseous material at atmospheric pressure while said airlock is closed;
evacuating said first and said second vacuum chambers;
transporting said substrate from said first vacuum chamber to said second vacuum chamber;
introducing a second gaseous material comprising silicon and hydrogen into said second vacuum chamber; and,
applying a **glow discharge** to a region in said second vacuum chamber to said second gaseous material, said glow discharge depositing a film comprising silicon on said substrate while maintaining said second gaseous material at sub-atmospheric pressure, while maintaining said substrate at a temperature and while said airlock is closed.

(PPC Exh. A, the '784 Patent, at col. 12, lns. 27-46 (emphasis added)).

1. The Parties' Proposed Constructions

a. PPC's Proposed Construction

The patent holder, PPC, argues that the disputed claim term should be construed as follows:

> "glow discharge" is a PECVD glow discharge created by ionization in an electric field of film producing gaseous materials from a source external to the enclosure or chamber.

(PPC's Opening Br. at 20).

b. CMO's Proposed Construction

The alleged infringer, CMO, argues that the disputed claim term should be construed as follows:

> "glow discharge" is an electric discharge through a gas that is generated using electric power and frequency levels lower than those required to break down pure nitrogen.

(CMO's Opening Br. at 4).

2. The Parties' Rationale

a. Summary of PPC's Arguments

PPC offers the following arguments in support of its proposed construction of the disputed term:

(1) The meaning is clear when analyzed in light of the patent specification. (See PPC's Opening Br. at 20).
(2) The prosecution history does not support CMO's proposed construction. (See PPC's Opening Br. at 22-23; PPC's Opp. Br. at 7-9; Markman Hr'g Tr. 24:11-25).
(3) A fair reading of the complete prosecution history supports PPC's proposed construction. (See PPC's Opening Br. at 22-23; PPC's Opp. Br. at 7-9; Markman Hr'g Tr. 21:3-7).
(4) Claim differentiation supports PPC's proposed construction. (See PPC's Opening Br. at 21-22; PPC's Opp. Br. at 7-9; Markman Hr'g Tr. 21:8-13).
(5) PECVD should be included in the construction because that is how "glow discharge" is understood in the art. (See PPC's Opp. Br. at 5).

b. Summary of CMO's Arguments

CMO asserts the following arguments in support of its proposed construction of the disputed term:

(1) The specification supports the proposed construction. "[A]ll of the examples in the specifications of the patents in suit disclosed 'relatively low power and frequency glow discharges.'" (See CMO's Opening Br. at 5; CMO's Opp. Br. at 2-3).

(2) The Inventor disclaimed the higher power and frequency levels in the prosecution history, based upon his disclosure in the Information Disclosure Statement ("IDS") to the PTO, wherein he discussed the differences between his claimed method and the method described in an Article entitled: "Plasma deposition: Apparatus for producing silicone [sic] nitride films" (the "IONICS Article") that discusses a prior art system -- the "LFE 8000 system." (See CMO's Opp. Br. at 2; CMO's Opening Br. at 5-6; Markman Hr'g Tr. 49:19 to 53:21).

(3) The phrase "PECVD glow discharge" was known in the art at the time of the filing of the patents-in-suit, yet the specifications of each of those patents and the claims do not include the phrase "PECVD." (See CMO's Opening Br. at 6-7, 8; CMO's Opp. Br. at 4).

(4) The specification discloses an example of non-PECVD glow discharge. (See CMO's Opening Br. at 7-8; CMO's Opp. Br. at 4; Markman Hr'g Tr. 76:23 to 77:14).

3. The Special Master's Recommended Construction

For the reasons discussed below, the Special Master finds that neither party has provided a proposed construction supported by the record. As such, the Special Master recommends the following construction for the disputed claim term "Glow Discharge":

> **A LUMINOUS TRANSIENT OR CONTINUOUS CONDUCTION OF ELECTRICITY THROUGH A GAS BY THE FORMATION AND MOVEMENT OF ELECTRONS AND IONS IN A CONTROLLED PRESSURE AND ELECTRIC FIELD UTILIZED IN CONNECTION WITH PLASMA ENHANCED CVD PROCESSING**

4. Discussion

a. CMO's Proposed Low Power And Frequency Limitation

CMO's principal arguments for the low power and low frequency limitation is a purported prosecution history disclaimer related to the IONICS article, and CMO's citation to several examples of low power and low frequency levels in the specification.

i. The IONICS Article

The IONICS article disclosure contained in an IDS, submitted to the PTO by the then applicant (the "Inventor"), does not rise to the level of clarity and unmistakable disavowal required by the Federal Circuit. See Honeywell Int'l, Inc. v. Universal Avionics Sys., 493 F.3d 1358, 1365 (Fed. Cir. 2007) (ambiguous passage is not a "sufficiently clear and deliberate statement [that] meet[s] the high standard for finding a disclaimer of claim scope"); Phillips v. AWH Corp., 415 F.3d 1303, 1317 (Fed. Cir. 2005) (as a product of negotiation between PTO and the applicant the prosecution history lacks clarity of specification); Inverness Med. Switz. GmbH v. Warner Lambert Co., 309 F.3d 1373, 1380-82 (Fed. Cir. 2002) (finding it "inappropriate to limit a broad definition of a claim term based on prosecution history that is itself ambiguous"); Athletic Alternatives, Inc. v. Prince Mfg., Inc., 73 F.3d 1573, 1580 (Fed. Cir. 1996) (finding that two contradictory interpretations of prosecution history rendered it unhelpful for claim construction). Where the asserted disavowal can be reasonably interpreted more than one way, it does not satisfy the high standard necessary for prosecution history disclaimer to impose a limitation not otherwise found in the claim language itself. See Honeywell, 493 F.3d at 1365; Inverness Med. Switz. GmbH, 309 F.3d at 1380-82; Athletic Alternatives, Inc., 73 F.3d at 1580.

While the cited communications between the Inventor and the Examiner includes a description by the Inventor of the LFE 8000 System as requiring high voltage sufficient to break

down pure nitrogen, it also includes the difference of the electric power source, i.e., the external inductive coil used in the LFE system versus the internal capacitively coupled power generation used by the Inventor. (See PPC's Exh. E, the '648 Patent File History, Paper No. 17 at 4-5; PPC's Opening Br. at 22-23; PPC's Opp. Br. at 7-9). Since both of the elements were highlighted by the Inventor, and neither is exclusively dependent upon the other, the level of clarity needed to discern that the Inventor intended one difference and not the other, or both, is absent and, thus, fails to satisfy the Federal Circuit's standards for prosecution history disclaimer. See Honeywell, 493 F.3d at 1365; Inverness Med. Switz. GmbH, 309 F.3d at 1380-82; Athletic Alternatives, Inc., 73 F.3d at 1580.

ii. The Low Power And Low Frequency Level Examples In The Specification

CMO's identification of several examples of low power and low frequency levels disclosed in the specification do not provide a limitation that should be imposed upon the claims of the patents-in-suit since the examples lack any clear supporting language in the specification or in the claims that specifically declares those limited levels are mandated. See Conoco, Inc. v. Energy & Envtl. Int'l, L.C., 460 F.3d 1349, 1358 (Fed. Cir. 2006) (absent express language in the claim no numerical limit imposed on general descriptive claim language); Reinshaw PLC v. Marposs Societa' Per Azioni, 158 F.3d 1243, 1249 (Fed. Cir. 1998) (absent clear directive in specification no limitation is read from the specification into the claims). In the absence of clear claim language, or clearly intended restrictive language in the specification or prosecution history, mere examples of numerical limitations will not be imposed upon the claims. Astra Aktiebolag v. Andrx Pharms., Inc., 483 F.3d 1364, 1372 (Fed. Cir. 2007) (absent clear intent court will not import examples in the specification into the claims); Conoco, Inc., 460 F.3d at 1358. Rather, the examples are treated as that – examples. See Astra Aktiebolag, 483 F.3d at

1372. Certainly, there is no clear reason, based on the record before the Special Master, to import a limitation into the claims from the embodiments in the patent specification, in contravention of the Federal Circuit's strong proscription against such an exercise. See Ventana v. Med. Sys., Inc. v. Biogenex Labs., Inc., 473 F.3d 1173, 1181-82 (Fed. Cir. 2006) (federal circuit has "repeatedly warned against confining the claims" to specific embodiments); Collegenet, Inc. v. Applyyourself, Inc., 418 F.3d 1225, 1231 (Fed. Cir. 2005) (specification is examined for context and not to import limitations into the claims); Phillips v. AWH Corp., 415 F.3d 1303, 1323 (Fed. Cir. 2005) (purpose of specification's embodiments is to teach, enable and provide best mode not to provide limitations to confine the claims); Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1326 (Fed. Cir. 2002) (claims must be read in light of specification but not limited by everything expressed in the specification).

The Special Master also finds that the examples averred to by CMO are further disarmed by PPC's identification of examples of higher power and frequency levels disclosed in the specification. (See PPC's Opening Br. at 21; PPC's Opp. Br. at 6; Markman Hr'g Tr. 21:24 to 23:5). The inclusion of examples of myriad power and frequency levels, low and high, demonstrates an adherence to a range of levels rather than a preference of one over the other. See Astra Aktiebolag, 483 F.3d at 1372 (absent clear intent court will not import examples in the specification into the claims); Conoco, Inc., 460 F.3d at 1357-58 (absent express language in the claim no numerical limit imposed on general descriptive claim language). Additionally, PPC points to the Inventor's recognition articulated in the specification that his "garage style" developmental work differed from what he anticipated in production. (PPC's Opening Br. at 21; PPC's Opp. Br. at 6; Markman Hr'g Tr. 21:24 to 23:5; PPC's Exh. B, the '648 Patent, at col. 7, lns. 6-9). Specifically, the Inventor declared "[i]n practice, I found that transformer 152 of the neon-sign type was convenient for developmental-size models. In production, larger, self-

regulating SCR, or saturable reactor transformers can be used." (PPC's Exh. B, the '648 Patent, at col. 7, lns. 6-9).

Lastly, the Special Master agrees with PPC's assertion that the claim construction doctrine of claim differentiation, i.e., a limitation found in a dependent claim should not be included in an independent claim when it does not exist without it, supports its position. (See PPC's Opening Br. at 21-22; Markman Hr'g Tr. 21:8-13). Specifically, PPC points out that asserted Claim 5 of the '648 Patent includes the disputed term "Glow Discharge," and dependent Claim 7 of the '648 Patent explicitly recites "low frequency components" as its sole additional limitation. (See PPC's Opening Br. at 21-22; PPC's Exh. B, the '648 Patent, at col. 9, lns. 62-65 & col. 9, lns. 37-56). The doctrine of claim differentiation, while not dogmatically applied, does nevertheless apply in the absence of clear limitations in the independent claim, the specification or the prosecution history. See RF Delaware, Inc. v. Pacific Keystone Techs., Inc., 326 F.3d 1255, 1263 (Fed. Cir. 2003) (doctrine of claim differentiation is applicable where a limitation found in a dependent claim is the only meaningful difference between it and the independent claim); Glaxo Group Ltd. v. Ranbaxy Pharms., Inc., 262 F.3d 1333, 1336 (Fed. Cir. 2001) (dependent claim generally narrower in scope than independent claim from which it depends); Clearstream Wastewater Sys. v. Hydro-Action, 206 F.3d 1440, 1446-47 (Fed. Cir. 2000) (under doctrine of claim differentiation the narrower term of a dependent claim cannot be read into the independent claim from which it depends). Certainly, in the context of the present discussion, the Special Master finds that the doctrine of claim differentiation provides additional support for rejecting CMO's proposed construction of the disputed term, "Glow Discharge," inasmuch as its proposal includes the limiting language "using electric power and frequency levels lower than those required to break down pure nitrogen."

iii. The Combination Of The Specification And Prosecution History Arguments

For the reasons stated in the separate discussion for each of CMO's arguments, in sections IV.A.4.a.i. and IV.A.4.a.ii., supra, the combination of the two bases does not provide any additional support for CMO's proposed construction.

b. PPC's "PECVD" Limitation

PPC has included in its proposed construction of the disputed term, "Glow Discharge" the limiting language "a PECVD glow discharge." The Special Master has included a variation of the PECVD limitation in the recommended claim construction for reasons other than those offered by PPC. The reasons are discussed below.

i. The Understanding In The Art

PPC has offered, as support for its PECVD limitation in its proposed construction, the understanding in the art and the Inventor's irreproachable understanding of the meaning of the disputed term based upon his own work and contribution to the art. (See PPC's Opp. Br. at 5). The essence of PPC's argument is that, because the term was so well understood by the Inventor and his peers in the art, it is a forgone conclusion that when he used the term, "Glow Discharge," within the context of this art, it was understood to mean "PECVD Glow Discharge." (See id.).

CMO has offered the same basis, i.e., the understanding in the art, in support of its argument, which is contrary to PPC's position, that in light of this "well known concept" the Inventor should have used the specific phrase either in the specification or in the claim language itself and did not. (See CMO's Opening Br. at 6-7, 8; CMO's Opp. Br. at 4). Furthermore, CMO takes issue with PPC's description of the understanding in the art, in the relevant timeframe, insisting that it was not a forgone conclusion; and, CMO asserts that the shorthanded use of

"Glow Discharge" was susceptible of at least more than one meaning within the context of the art. (See CMO's Opening Br. at 6-7, 8; CMO's Opp. Br. at 4; Markman Hr'g Tr. 77:3-9).

The evidence offered by both parties, regarding the issue of what was understood in the art, fails to compel a conclusion adopting the position of one side or the other. Cf. Phillips, 415 F.3d at 1314 (where ordinary meaning to one skilled in the art is not readily apparent other sources for claim interpretation must be investigated). Moreover, if one is to believe that the understanding in the art is a given, or that it was not so clear-cut, then either side might be correct.

ii. The Specification And The Prosecution History

CMO has also pointed to a description in the specification, relating to one of the embodiments in the specification, of a glow discharge "sputtering" technique as an example of non-PECVD glow discharge. (See CMO's Opening Br. at 8; Markman Hr'g Tr. 64:2-14, 76:23 to 77:14). PPC counters CMO's argument regarding the sputtering technique as not mutually exclusive with PECVD. (See Markman Hr'g Tr. 67:16 to 70:10). For reasons discussed more fully below, the Special Master finds that the inclusion of a non-PECVD glow discharge technique in the specification for the family of patents does not, in itself, negate PPC's proposed construction.

iii. Inclusion Of The PECVD Limitation

The Special Master's exhaustive inspection and review of the substantial prosecution history for the family of patents has yielded a definitive resolution to the question of whether PECVD should be included as a limitation in the construction of the disputed term, "Glow Discharge." The Special Master's answer to this question is in the affirmative.

During the prosecution of the '648 patent, the then applicant, submitted a response on November 9, 1998, to a final office action rejection from the PTO, using clear language in

reference to the disputed term. In traversing a judicially created double-patenting rejection, and a 35 U.S.C. § 112, first paragraph (written description) rejection, the Inventor referenced the claims and the embodiments in the specification in terms of PECVD. (See CMO's Exh. 14 at 27-28, 31-32). Specifically, with respect to the double patenting rejection, the Inventor discussed the "claims of the present invention, as amended" to point out what was new and absent from the claims of his prior patent (the '897 patent), and stated that:

> The claims of the present invention, as amended, are directed toward the allowable subject matter indicated in the April 22, 1997 Office Action -- namely: (1) the use of "[h]alogen as the gaseous material"; (2) "rotating the substrate around an axis to move the substrate from one region to another"; and (3) plasma deposition in which the film-forming gas is "introduced toward said substrate with at least a radially outward component of flow over said substrate surface" (allowable claim 85); (see Office Action, mailed 4/22/97). In addition, **all of the pending claims are directed to glow-discharge (plasma) enhanced CVD** in two or more chambers.
>
> Thus, applicant contends that the present application (which defines what is new, rather than what is old), including the claims as amended, precisely sets forth the subject matter that applicant regards as his invention, and that one skilled in the art as of the Priority Date, would have understood that applicant was in possession of the claimed invention.

(CMO's Exh. 14 at 27-28 (second emphasis added)).

With respect to the Section 112, first paragraph, rejection, the Inventor identified what was disclosed in the specification's written description to overcome the rejection by describing each and every embodiment as follows:

> Applicant's possession of knowledge concerning glow discharge deposition of films to fabricate semiconductors in a single process chamber is beyond reproach. Various operating conditions used to form semiconductors are described in my U.S. Patents Nos. 3,068,283 and 3,068,510. The reference on page 3 of the present specification to those patents shows that applicant was "in possession" of the material disclosed therein at the time of the Priority Date. Further variants of **glow discharge plasma CVD processing are described in the specification with respect to figures 1-3, 5 and 7-9 (figure 4 shows a multi-chamber inline system, while figure 6 shows refers [sic] to a multi-chamber rotary system)**.

(CMO's Exh. 14 at 31-32 (emphasis added)).

The Inventor's statements to the Examiner cited above are important for several reasons. First, it is clear from the prosecution history that the first of these statements was made in an effort to overcome a double-patenting rejection of the '648 patent application based upon one of three of the Inventor's prior patents issuing from the same disclosure: the '115 patent (not asserted in this litigation); the '784 patent (asserted as infringed in this litigation); and, the '897 patent (not asserted in this litigation). While all three of these patents were included in the double-patenting rejection, two were eliminated by the Inventor's agreement to a Terminal Disclaimer (the '115 and '784 patents). (See CMO's Exh. 14 at 27). Thus, the said statement made by the Inventor was directed specifically to distinguishing the '897 patent in his effort to overcome the double-patenting rejection. (See id.).

Second, the Inventor's statements represent a clear description of "PECVD" type processing that should attach to the claim term "Glow Discharge" in all of the claims included in the '648 patent. Moreover, it serves as clear evidence to describe what the Inventor intended "Glow Discharge" to mean when including the disputed term in his then pending claims (which includes the Independent claim that matured to the asserted '648 Claim 5 as well as the dependent claims which are asserted in this litigation). See Lemelson v. Gen. Mills, Inc., 968 F.2d 1202, 1206 (Fed. Cir. 1992) (the prosecution history provides evidence of how the PTO and the inventor understood the patent).

Third, with respect to the Section 112 related statement, it is clear that in overcoming the Section 112, first paragraph, rejection, the Inventor specifically identified every embodiment in the specification's written description as describing "glow discharge plasma CVD processing." (See CMO's Exh. 14 at 31-32). This provides clear evidence that the Inventor described glow discharge processing as plasma CVD processing. Furthermore, absent clear evidence to the

contrary, this intrinsic evidence from the '648 prosecution history applies to the other two patents-in-suit (the '634 and '784 patents). See NTP, Inc. v. Research in Motion, Ltd., 418 F.3d 1282, 1293 (Fed. Cir. 2005) (claims of patents derived from same parent application sharing many common terms should be interpreted consistently across the patents); Microsoft Corp. v. Multi-Tech Sys., Inc., 357 F.3d 1340, 1349 (Fed. Cir. 2004) (prosecution history of one patent is relevant to understanding of scope of a common term in a second patent stemming from same patent application). This is especially true where, as here, the specification is substantially the same for each of the patents-in-suit. See NTP, Inc., 418 F.3d 1282 at 1293; Microsoft Corp., 357 F.3d 1340 at 1349. Additionally, where the public notice function of the patent system and the factual circumstances of the case do not dictate a contrary result, the parties' agreement that the disputed terms appearing in the multiple patents-in-suit be construed the same for all the patents-in-suit, is appropriate. Cf. Phillips v. AWH Corp., 415 F.3d 1303, 1319 (Fed. Cir. 2005) (recognizing public notice function of patents); AK Steel Corp. v. Sollac, 344 F.3d 1234, 1243 (Fed. Cir. 2003) (different construction for two similar claims in related patents sharing the same specification compelled by the relevant facts).

The inclusion of a non-PECVD glow discharge sputtering technique example in the specification's written description of one embodiment does not warrant a contrary conclusion. First, the clear statements made by the Inventor in the '648 prosecution history to overcome the rejections may be viewed as a clear disclaimer of any glow discharge processing, including the sputtering technique, other than PECVD. See N. Am. Container, Inc. v. Plastipak Packaging, Inc., 415 F.3d 1335, 1345 (Fed. Cir. 2005) (finding high standard of clarity for prosecution disclaimer was met); Omega Eng., Inc. v. Raytek Corp., 334 F.3d 1314, 1324-25 (Fed. Cir. 2003) (stating that "the prosecution history indicates that a clear and unmistakable disclaimer occurred regarding the [disputed term]"). Furthermore, while it is noted that the Federal Circuit

warns against construing the claims in a patent not to include a disclosed embodiment in the claims, there are rare but clear cases where it is, in fact, so construed. See N. Am. Container, Inc., 415 F.3d at 1346 (Fed. Cir. 2005) (stating that "limitations may be construed to exclude a preferred embodiment if the prosecution history compels such a result); Rheox, Inc. v. Entact, Inc., 276 F.3d 1319, 1327 (Fed. Cir. 2002) (finding it permissible to exclude a preferred embodiment "where the prosecution history requires a claim construction that excludes some but not all of the preferred embodiments"); Elekta Instrument S.A. v. O.U.R. Sci. Int'l, Inc., 214 F.3d 1302, 1308 (Fed. Cir. 2000) (finding that the prosecution history and unambiguous language of the amended claim compelled a construction that excluded the "preferred and only embodiment") (emphasis added). It is also true that the prohibition applies with greater force when, unlike the instant matter, the patent specification contains only one disclosed embodiment. See, e.g., Sinorgchem Co. v. ITC, 511 F.3d 1132, 1138 (Fed. Cir. 2007) (prohibition applies with greater force where claims as construed do not include any disclosed embodiment); Johns Hopkins Univ. v. Cellpro, Inc., 152 F.3d 1342, 1355 (Fed. Cir. 1998) (claim construction should read on the only disclosed embodiment absent highly persuasive evidence to the contrary); Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1583 (Fed. Cir. 1996) (same). Nevertheless, when the prosecution history disclaimer is clear and unambiguous the prohibition against a claim construction that reads out a disclosed embodiment does fall. See N. Am. Container, Inc., 415 F.3d at 1346; Rheox, Inc. v. Entact, Inc., 276 F.3d at 1327; Elekta Instrument S.A., 214 F.3d at 1308.

Second, where the same embodiment, contained in the same specification, that might arguably be read out of the patent claims in a descendant patent, was included in a claim in the parent patent, the prohibition is arguably not violated. Here, while the sputtering technique may have had meaning for the '897 patent, it is clear from the claim language of the '897 patent, and

from the prosecution history, that it is not intended to be part of the "Glow Discharge" claim term for the patents-in-suit. Dependent Claim 37 of the '897 patent includes the "sputtering" language whereas none of the claims of the patents-in-suit include it. (See PPC's Exh. I, the '897 Patent, at col. 12, lns. 19-22). Where the prosecution history disclaimer is clear and unambiguous, and the Inventor used the sputtering language in a claim where he clearly intended the technique to be claimed, there is ample support for the Special Master's inclusion of the "PECVD" limitation in the construction of the disputed claim term, "Glow Discharge," notwithstanding the sputtering language disclosure in the specification.

Third, the Special Master finds that, consistent with an explanation alluded to by PPC during the Markman Hearing, PECVD and the sputtering technique are not mutually exclusive and can co-exist to the extent that glow discharge as described in all of the embodiments of the specification always includes PECVD. (See Markman Hr'g Tr. 67:16 to 70:10). There can be no question, based upon the statements made by the Inventor in the '648 prosecution history, that, at minimum, the disputed term includes PECVD. (See CMO's Exh. 14 at 28, 31-32). Furthermore, the explicit inclusion of the sputtering technique in a dependent claim in the '897 patent (Claim 37) that is dependent from independent Claim 2, which includes the disputed term "Glow Discharge," provides additional inferential support for co-existence. (See PPC's Exh. I, the '897 Patent, at col. 12, lns.19-22 & col. 9, lns. 34-44). Moreover, claim differentiation and non-redundancy of claim terms, supports a finding that the Inventor did not intend the usage and scope of the disputed term, "Glow Discharge," to include the sputtering technique. See Acumed LLC v. Stryker Corp., 483 F.3d 800, 806 (Fed. Cir. 2007) (claim differentiation raises presumption that limitation in a dependent claim is not present in independent claim); SunRace Roots Enter. Co., Ltd. v. SRAM Corp., 336 F.3d 1298, 1303 (Fed. Cir. 2003) (claim differentiation presumption particularly strong when limitation in dependent claim is only

meaningful difference between it and independent claim and contrary construction would render the dependent claim redundant) (emphasis added).

Thus, whether on the basis of prosecution history disclaimer, claim differentiation, or co-existence, the Special Master finds that the disputed claim term, "Glow Discharge," does not include sputtering but rather connotes, as claimed in the patents-in-suit, PECVD processing.

One final note regarding the PECVD limitation. It is noted that the circumstances being argued for prosecution history disclaimer are somewhat unique in that the patent holder and the accused infringer are in opposite positions from the customary breadth of claim language arguments. (See Markman Hr'g Tr. 63:8-25). Nevertheless, the result of the prosecution history disclaimer still obtains. Moreover, the Inventor's statements made to the Examiner provide clear guidance buttressing the Inventor's intended meaning for "Glow Discharge" in the context of the patent claims for the patents-in-suit.

c. The Remainder Of The Special Master's Recommended Construction

In addition to the bases for inclusion of the PECVD limitation, as discussed above, the Special Master relied upon certain intrinsic and extrinsic evidence for the balance of his recommended construction of the disputed term. Since neither party provided a proposed construction supported by the record evidence, and since defining a disputed term by its own terms does not inform the process, the Special Master's recommended construction addresses those issues. See Abbott Labs. v. Sandoz, Inc., 544 F.3d 1341, 1360 (Fed. Cir. 2008) (explaining and defining use of words in a claim requires use of words other than the words of the disputed claim term being defined).

As for the extrinsic evidence, within the context of, and not contrary to, the patent claims' meaning and scope, "luminous" is an ordinary and customary definition of the "Glow" component of "Glow Discharge." (See Funk & Wagnalls, New Comprehensive International

Dictionary of the English Language, Encyclopedic Edition 539 (1978) (attached as Appendix 'B' hereto); H. J. Gray, A New Dictionary of Physics 236 (H. J. Gray & Alan Isaacs eds. 1975) (attached as Appendix 'C' hereto)); see also Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1584 n.6 (Fed. Cir. 1996) (appropriate to construe claim term in reliance upon dictionary definition that does not contradict the intrinsic evidence). The following two dictionary definitions are illustrative:

> **glow discharge** ***n.***
> The initial luminous electrical discharge in a gas, as observed in neon lamps, etc.

(Funk & Wagnalls, New Comprehensive International Dictionary of the English Language, Encyclopedic Edition 539 (1978) (emphasis added)).

> **glow discharge**
> An electric discharge through a gas, usually at a relatively low pressure, in which the gas becomes luminous. *See* gas-discharge tube.

(H. J. Gray, A New Dictionary of Physics 236 (H. J. Gray & Alan Isaacs eds. 1975) (emphasis added)).

"Transient or continuous conduction of electricity through a gas by the formation and movement of electrons and ions" is an ordinary and customary definition of "Glow Discharge" as understood within the context of general physics and the patents. (See H. J. Gray, A New Dictionary of Physics 230, 236 (H. J. Gray & Alan Isaacs eds. 1975) (describing detailed characteristics of glow discharge through related definition of cross-referenced "gas-discharge tube"); J. Thewlis, Concise Dictionary of Physics 97 (1973) (describing glow discharge characteristics) (attached as Appendix 'D' hereto).

The remainder of the construction, "in a controlled pressure and electric field," finds intrinsic evidentiary support in the specification's "Abstract" and the specification's "Summary of the Invention" from all three patents-in-suit. See, e.g., Hill-Rom Co. v. Kinetic Concepts, Inc., 209 F.3d 1337, 1341 (Fed. Cir. 2000) (appropriate to look to Abstract for scope of invention);

Rexnord Corp. v. Laitram Corp., 274 F.3d 1336, 1345 (Fed. Cir. 2001) (Summary of Invention is a pertinent place to find what patentee has claimed). Specifically, the Abstract provides: "[i]n a gaseous glow-discharge process for coating a substrate with semiconductor material, a variable electric field in the region of the substrate and the pressure of the gaseous material are controlled to produce a uniform coating having useful semiconductor properties." (See PPC's Exh. B, the '648 Patent, title page, second col., "ABSTRACT" (emphasis added)). The Summary of Invention provides: "[t]he present process is designed to produce uniform semiconducting coating over a large area by means of a glow-discharge in which pressure and electric field are controlled." (See PPC's Exh. B, the '648 Patent, at col. 2, lns.11-14 (emphasis added)).

B. "EVACUATING SAID FIRST AND SAID SECOND VACUUM CHAMBERS"

The parties dispute the meaning of the claim term phrase "evacuating said first and said second vacuum chambers" as contained in the '784 Patent, asserted Claim Number 21. The claim language from that claim, with the disputed claim term highlighted in bold, is reprinted here:

From the '784 patent:

> 21. A method of fabricating a semiconductor device comprising the steps of:
> providing a first and second vacuum chambers;
> providing an airlock in said first vacuum chamber;
> disposing a substrate in said first vacuum chamber in a
> first gaseous material at atmospheric pressure while said airlock is closed;
> **evacuating said first and said second vacuum chambers**;
> transporting said substrate from said first vacuum chamber to said
> second vacuum chamber;
> introducing a second gaseous material comprising silicon and hydrogen into
> said second vacuum chamber; and,
> applying a glow discharge to a region in said second vacuum chamber to
> said second gaseous material, said glow discharge depositing a film
> comprising silicon on said substrate while maintaining said second
> gaseous material at sub-atmospheric pressure, while maintaining
> said substrate at a temperature and while said airlock is closed.

(PPC Exh. A, the '784 Patent, at col. 12, lns. 27-46 (emphasis added)).

1. The Parties' Proposed Constructions

a. PPC's Proposed Construction

PPC argues that no construction is necessary. However, if the term is construed, PPC argues that the disputed claim term should be construed as follows:

> "evacuating" the vacuum chamber is pumping the gas therein to be substantially lower than the operating pressure in that chamber.

(PPC's Opening Br. at 18).

b. CMO's Proposed Construction

CMO argues that the disputed claim term should be construed as follows:

> emptying the gases from the first and second chambers, for example, by pumping down the pressure in the chamber to not more than .02 Torr.

(CMO's Opening Br. at 20).

2. The Parties' Rationale

a. PPC's Arguments

PPC offers the following arguments in support of its proposed construction of the disputed term:

(1) The language should be construed according to its plain meaning because the language is clear and unambiguous and would be easily understood by a jury. (See PPC's Opening Br. at 18).

(2) CMO's approach ignores a basic claim construction canon that one may not read a limitation into a claim from the written description. (See PPC's Opening Br. at 19; Markman Hr'g Tr. 169:18 to 170:17).

(3) There is no support anywhere in the specification for restricting the claims to any specific pressure value or any upper or lower limits on the pressure in the vacuum chambers. (See PPC's Opening Br. at 19; PPC's Opp. Br. at 19).

b. CMO's Arguments

CMO asserts the following arguments in support of its proposed construction of the disputed term:

(1) The specification supports the proposed construction. From "the '784 Patent, for example, at column 3, lines 33-35 ('[i]n operation, the enclosure 6 is evacuated by pump 20 to a pressure below about 0.02 Torr'), line 61 ('residual gases evacuated to background by pump 20') and line 67 ('the residual gases in enclosure 6 evacuated by pump 20'). (Ex. 3.)[.]" (See CMO's Opening Br. at 21).

(2) PPC's proposal of "lowering" the pressure is unsupported by the intrinsic record. (See CMO's Opening Br. at 21).

(3) PPC's proposal of "lowering" the pressure "substantially below" an "operating pressure" is undefined, introduces more ambiguity and indefiniteness, and is unsupported by the intrinsic record. (See CMO's Opening Br. at 21-22).

(4) PPC's proposed construction is erroneous because it encompasses any reduction in the pressure in a chamber, regardless of magnitude, contrary to the specification of the patent-in-suit. (See CMO's Opp. Br. at 12).

3. The Special Master's Recommended Construction

For the reasons discussed below, the Special Master finds that, while neither party has provided a distinct proposed construction that is supported by the record, the elements of the parties' separate proposals that are essentially in agreement provide the proper construction supported by the record. Thus, the Special Master recommends the following construction for the disputed claim term "Evacuating Said First and Said Second Vacuum Chambers":

> **EMPTYING THE GASES FROM THE VACUUM CHAMBERS BY PUMPING DOWN THE PRESSURE IN EACH CHAMBER**

4. Discussion

a. PPC's "No Construction Necessary" Proposal

PPC's argument that no construction is necessary, because the plain meaning of the term "evacuating" is easily understood by the jury, fails because, contrary to PPC's position, the term

"evacuating" does need some additional distillation in itself and, of course, within the context of the patent. See Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) (stating that disputed term should be construed in the context of the entire patent). Evacuating has several meanings depending on the context (leaving a building, a plane, escaping a fire, draining a pool, etc.). (See Funk & Wagnalls, New Comprehensive International Dictionary of the English Language, Encyclopedic Edition 439 (1978); see also V. John Andrew Simpson and Edmund S. C. Weiner, The Oxford English Dictionary 445 (2d. ed. 1989) (defining evacuate and identifying its origin of usage) (attached as Appendix 'E' hereto)). However, there is one aspect of the meaning of evacuating that remains constant no matter the context; once "evacuated" the area left behind is void of the previous contents or occupants (i.e., it is empty). (See Funk & Wagnalls, New Comprehensive International Dictionary of the English Language, Encyclopedic Edition 439 (1978); V. John Andrew Simpson and Edmund S. C. Weiner, The Oxford English Dictionary 445 (2d. ed. 1989)).

Additionally, both parties recognize that the purpose for the evacuating process is to prepare the environment of the vacuum chamber for the next processing step(s) by removing the gases or air from the chamber to achieve a near-vacuum sub-atmospheric pressure state. (See Markman Hr'g Tr. 183:18 to 187:4 (PPC); Markman Hr'g Tr. 198:13 to 199:10 (CMO)). Also, the parties agree that the removal of the air or gases is not absolute, i.e., no complete vacuum is achieved. (See Markman Hr'g Tr. 183:18 to 184:7 (PPC); Markman Hr'g Tr. 198:6-16 (CMO)). Thus, it is with this understanding that each party equates evacuating with emptying. Specifically, PPC pointed out during the Markman Hearing that "[i]t [evacuating] means exactly that, evacuating the chambers, pumping them down to bring them to an empty state essentially." (Markman Hr'g Tr. 167:3-6). CMO also used "emptying" during the Markman Hearing to describe evacuating, as follows: "I think evacuating is emptying ... I submit, and this is pretty

close to what I understand CMO's definition is, too, I respectfully submit evacuating is emptying." (Markman Hr'g Tr. 198:6-12). Therefore, viewed within the context of the patents, the intrinsic record, and the parties' understanding of same, there can be no doubt that the construction of the disputed claim term must include emptying to describe the function of evacuating.

There is also much common ground between the parties regarding how the evacuating process is performed. Each party has suggested that "evacuating" is "pumping down" (CMO), or "pumping the gas substantially lower" (PPC). (See CMO's Opening Br. at 20-21; PPC's Opening Br. at 19; Markman Hr'g Tr. 195:6-9 (CMO); Markman Hr'g Tr. 172:23 to 174:21 (PPC)). This common ground is supported by the intrinsic record. (See PPC Exh. A, the '784 Patent, at col. 3, lns. 33-35, 61, 67 (specification); PPC Exh. B, the '648 Patent, at col. 3, lns. 33-35, 61, 67 (same)). Thus, "evacuating" the vacuum chambers is emptying the vacuum chambers by "pumping down" the pressure in the chamber.

b. PPC's "Pumping The Gas Therein To Be Substantially Lower Then The Operating Pressure In The Chamber" Proposal

PPC's proposed construction, in the alternative of plain meaning, which includes the phrase "substantially lower than the operating pressure in the chamber" introduces more questions than it answers. What is intended by "substantially lower?" What is the meaning of "operating pressure?" How much gas can remain after "substantially removing gases?" As aptly pointed out by CMO, the proposed language creates more ambiguity and does not inform the analysis nor provide clarity for the disputed term phrase. (See CMO's Opening Br. at 21-22; CMO's Opp. Br. at 13; Markman Hr'g Tr. 197:18 to 198:6).

c. CMO's Intrinsic Record Arguments Against "Lowering"

CMO also opposes PPC's inclusion of "lowering" as a defining measure since the Inventor referred to lowering in connection with the "adjusting" term in the context of the patent. (See CMO's Opp. Br. at 12-13). Moreover, CMO points to examples in the specification that CMO asserts distinguishes between "evacuating" and "adjusting" when referring to different processes of the invention. (See id.) Specifically CMO argues the distinction between "evacuating" and "lowering":

> For example, with respect to the former, the specification discloses that "the enclosure 6 is evacuated by pump 20 to a pressure below about 0.02 Torr" in column 3 at lines 31-34. ('648 patent (Ex. 4), col. 3, ll. 31-34 Conversely, with respect to the latter, the specification discloses in the same paragraph that "the pressure PG of silane is adjusted to 0.3 to 0.4 Torr to position a diffuse discharge P in the region above plate 100 . . . ." (*See* '684 [sic] patent (Ex. 4), col. 3, ll. 35-55 (emphasis added).) **Coleman's use of two different terms to refer to different processes demonstrates that "evacuating" necessarily means something more than simply lowering (adjusting) the pressure in the chamber.**

(See CMO's Opp. Br. at 12-13 (emphasis added)).

CMO continues its argument, against using "lowering," and as additional support for its inclusion of 0.02 Torr as a numerical limitation, by asserting:

> With respect to the term "evacuating" requiring reduction to a particular numerical value, Defendants note that "evacuating" cannot possibly include reducing the pressure to only 0.3 Torr as Plaintiffs suggest, since Coleman used that specific value to represent "adjusting" and not "evacuating" (which is described in the specification as 0.02 Torr).

(See id. at 13).

While the Special Master agrees with so much of CMO's assertion that "lowering" is not an appropriate interpretation for evacuating, the Special Master disagrees with CMO's reading of the specification. There is no clear statement by the Inventor that the usage of lowering in the specification, to describe adjusting in one process of the invention and not to describe evacuating

for a different process of the invention, was intended to include lowering for the adjusting and exclude it from evacuating. See, e.g., Epistar Corp. v. ITC, 566 F.3d 1321, 1335-36 (Fed. Cir. 2009) (inventor's intentional disclaimer or disavowal of claim scope in specification must be clear); Phillips v. AWH Corp., 415 F.3d 1303, 1316 (Fed. Cir. 2005) (recognizing specification may disclose intentional disavowal or disclaimer of claim scope by inventor). Certainly, the process of emptying the vacuum chamber by pumping down the pressure *includes* the act of lowering the pressure. However, lowering is not as exacting as emptying. It helps one get to the final destination but it *does not* define the end of the journey.

Indeed, CMO's assertion that "lowering," as included in PPC's proposal, "encompasses any reduction in pressure in a chamber," recognizes the insufficiencies attendant to the word. (See CMO's Opp. Br. at 13). However, CMO's attempt to correct the problem, by including a numerical limitation from the specification, is also rejected for reasons to be discussed in section IV.B.4.d., infra.

d. CMO's Inclusion Of The Specific Numerical Limitation Of "0.02Torr" In Its Proposal

As previously noted, CMO's attempt to ameliorate the ambiguity of including "lowering" in the interpretation of evacuating, by including a specific numerical limitation in the construction, goes too far. Without more, and in the absence of clear limiting language in the claims themselves, providing examples in the written description does not warrant limiting the claim language to those written description examples. See Conoco, Inc. v. Energy & Envtl. Int'l, L.C., 460 F.3d 1349, 1358 (Fed. Cir. 2006) (absent express language in the claim no numerical limit imposed on general descriptive claim language); Reinshaw PLC v. Marposs Societa' Per Azioni, 158 F.3d 1243, 1249 (Fed. Cir. 1998) (absent clear directive in specification no limitation is read from the specification into the claims).

CMO's identification of "below 0.02 Torr" as the desired level of pressure disclosed in the specification does not provide a limitation that should be imposed upon the claims of the patent-in-suit since it lacks any clear language in the specification or in the claims that specifically declares those limits are mandated. See Conoco, Inc., 460 F.3d at 1358; Reinshaw PLC, 158 F.3d at 1249. In the absence of clear claim language, or clearly intended restrictive language in the specification or the prosecution history, mere examples of numerical limitations will not be imposed upon the claims. See Astra Aktiebolag v. Andrx Pharms., Inc., 483 F.3d 1364, 1372 (Fed. Cir. 2007) (absent clear intent court will nor import examples in the specification into the claims); Conoco, Inc., 460 F.3d at 1358. Rather, the examples are treated as that – examples. See Astra Aktiebolag, 483 F.3d at 1372. Certainly, there is no clear reason, on the basis of the record before the Special Master, to import a limitation on the claims from an embodiment in the patent specification, in contravention of the Federal Circuit's strong proscription against such an exercise. See Ventana v. Med. Sys., Inc. v. Biogenex Labs., Inc., 473 F.3d 1173, 1181-82 (Fed. Cir. 2006) (federal circuit has "repeatedly warned against confining the claims" to specific embodiments); Collegenet, Inc. v. Applyyourself, Inc., 418 F.3d 1225, 1231 (Fed. Cir. 2005) (specification is examined for context and not to import limitations into the claims); Phillips v. AWH Corp., 415 F.3d 1303, 1323 (Fed. Cir. 2005) (purpose of specification's embodiments is to teach, enable and provide best mode not to provide limitations to confine the claims); Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1326 (Fed. Cir. 2002) (claims must be read in light of specification but not limited by everything expressed in the specification).

As pointed out by PPC, the specification includes several numerical values for the pressure range and thus is not clearly restricting the claims to one target value. (See PPC Opp. Br. at 19; Markman Hr'g Tr. 167:15 to 169:11).

> [T]here is no support anywhere in the specification for restricting the claims to any specific pressure value or any upper or lower limits on the pressure in the vacuum chambers. (*See* Plaintiffs' Opening Memorandum of Law Regarding Claim Construction at 18-19). In fact, the specification clearly recites evacuating in some instances to a pressure of significantly more than 0.02 Torr. (*See* Exh. A, '784 Patent at col. 3, lns. 52-53) ("Next, the pressure PG of silane is adjusted to 0.3 to 0.4 Torr to position a diffuse discharge P . . ."). Moreover, Mr. Coleman specifically disclosed using a gauge VG, which "meters the eva[c]uation of enclosure 6 and pressure of gases . . . in the range of 0.001 to 10 Torr." (*See id.* at col. 3, lns. 18-23). The specification is thus not limited to the pressure ranges disclosed by CMO and Innolux. Their proposals should be rejected in view of Plaintiffs' proposal.

(See PPC Opp. Br. at 19).

Thus, the Special Master concludes that there is no clear and unambiguous support in the record for CMO's proposed limitation of "below 0.02 Torr" as the numerical value for the pressure in the evacuated vacuum chambers of the disputed claim term phrase.

C. SEQUENCE OF THE STEPS: "DISPOSING A SUBSTRATE IN SAID FIRST VACUUM CHAMBER IN A FIRST GASEOUS MATERIAL AT ATMOSPHERIC PRESSURE WHILE SAID AIRLOCK IS CLOSED" AND "EVACUATING SAID FIRST AND SECOND VACUUM CHAMBERS"

The parties dispute whether Claim number 21 of the '784 Patent requires an order or sequence of events for the "disposing" and "evacuating" steps. The claim language from Claim number 21 of the '784 Patent, with the disputed claim term sequence steps highlighted in bold (numbers added for step identification purposes only), is reprinted here:

> A method of fabricating a semiconductor device comprising the steps of:
>
> (1) providing a first and second vacuum chambers;
> (2) providing an airlock in said first vacuum chamber;
> (3) **disposing a substrate in said first vacuum chamber in a first gaseous material at atmospheric pressure while said airlock is closed;**
> (4) **evacuating said first and said second vacuum chambers;**
> (5) transporting said substrate from said first vacuum chamber to said second vacuum chamber;
> (6) introducing a second gaseous material comprising silicon and hydrogen into said second vacuum chamber; and,

(7) applying a glow discharge to a region in said second vacuum chamber to said second gaseous material, said glow discharge depositing a film comprising silicon on said substrate while maintaining said second gaseous material at sub-atmospheric pressure, while maintaining said substrate at a temperature and while said airlock is closed.

(PPC Exh. A, the '784 Patent, at col. 12, lns. 27-46 (emphasis added)).

1. The Parties' Proposed Constructions

a. PPC's Proposed Construction

PPC asserts that the disputed term sequence should be construed as follows:

> The steps of claim 21 do not actually recite an order and hence would not be correctly construed to require one.

(PPC's Opening Br. at 25).

b. CMO's Proposed Construction

CMO asserts that the disputed term sequence should be construed as follows:

> The disposing step must occur before the evacuating step.

(CMO's Opening Br. at 25).

2. The Parties' Rationale

a. PPC's Arguments

(1) Claim 21 of the '784 Patent does not provide any limitation respecting the order of steps. (See PPC's Opening Br. at 25).

(2) The Patent specification places no restriction on the order of the claimed steps. (See PPC's Opening Br. at 25).

(3) The Patent specification does not require that the evacuating of the first and second chambers occur simultaneously or that the second vacuum chamber be evacuated every time that the first vacuum chamber is evacuated. (See PPC's Opening Br. at 25-26). Specifically, PPC points out:

> The second vacuum chamber can be evacuated at any appropriate time without reference to when the first vacuum (loading) chamber is evacuated, because the two chambers are separated by an airlock (*see, e.g.*, Exh. A, '784 Patent at Fig. 4) which when closed restricts the flow of gas from entering or leaving from chambers 60, 62.

(PPC's Opening Br. at 25-26).

b. CMO's Arguments

(1) The plain language and internal logic of Claim 21 requires performing step (3) before performing step (4). (See CMO's Opening Br. at 23).

(2) The plain language and internal logic of the steps in Claim 21 immediately following steps [3] and [4] demonstrate that the steps must be performed in their recited order. (See CMO's Opening Br. at 24).

(3) The specification and prosecution history of the '784 Patent demonstrate that the "disposing" step must occur before the "evacuating" step. (See CMO's Opening Br. at 24-25).

3. The Special Master's Recommended Construction

For the reasons discussed below, the Special Master finds that the parties are in agreement regarding the order of the disposing step and evacuating of the first vacuum chamber. The remaining narrow disagreement is as to the order of the disposing step and the evacuating of the second vacuum chamber. The Special master rejects CMO's proposal with respect to the Second Vacuum Chamber and agrees with so much of PPC's proposal regarding the sequence of events for the Second Vacuum Chamber. Thus, the Special Master recommends the following construction for the disputed sequence of steps for the claim terms "Disposing a Substrate in Said First Vacuum Chamber in a First Gaseous Material at Atmospheric Pressure While Said Airlock is Closed" and "Evacuating Said First and Second Vacuum Chambers" :

> **THE "DISPOSING" STEP MUST OCCUR PRIOR TO THE "EVACUATING" STEP IN THE FIRST VACUUM CHAMBER. HOWEVER, THE "EVACUATING" STEP IN THE SECOND CHAMBER MAY OCCUR BEFORE OR AFTER SAID "DISPOSING" STEP, PROVIDED THAT THE AIRLOCK IS CLOSED AS PER THE DISPOSING STEP PRIOR TO EVACUATING THE SECOND VACUUM CHAMBER, AND PROVIDED FURTHER THAT BOTH THE FIRST AND SECOND VACUUM CHAMBERS HAVE BEEN EVACUATED PRIOR TO THE "TRANSPORTING" AND REMAINING STEPS IN CLAIM NUMBER 21 OF THE '784 PATENT**

4. Discussion

a. PPC's No Claim Language Or Specification Restriction Arguments

PPC argues, correctly, that there is no specific language in the '784 Patent Claim 21 limiting the order or sequence of the steps. (PPC's Opening Br. at 25). Likewise, PPC argues that there is nothing in the specification requiring a specific order. (Id.). CMO argues, to the contrary, that the plain language of the Claim and/or the specification requires the order it espouses. (See CMO's Opening Br. at 23-24).

The Special Master finds that there is no specific language in the claim or explicit direction in the specification, clearly requiring the order of the steps, (e.g., mandatory language like "the following steps must be performed in the exact order"). See Altiris, Inc. v. Symantec Corp., 318 F.3d 1363, 1369 (Fed. Cir. 2003) (absent clear or implied mandate in claim language or specification or resulting from the grammar and logic of method claim no order or sequence of steps is required); Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1342-44 (Fed. Cir. 2001) (same). Similarly, there is no implicit mandate in the claim language or in the specification. See Altiris, Inc., 318 F.3d at 1369-70; Interactive Gift Express, Inc., 256 F.3d at 1342-44.

b. CMO's Internal Logic Of The Claim Steps Arguments

In the absence of clear language in a method claim, or in the specification, particularly requiring the steps of the claim be performed in a specific order, no order is necessary unless mandated by the grammar and logic of the claim steps. See Altiris, Inc., 318 F.3d at 1369-70; Interactive Gift Express, Inc., 256 F.3d at 1342-44. Thus, the inquiry proceeds to determine whether "logic or grammar" dictates the order. See Altiris, Inc., 318 F.3d at 1369-70; Interactive Gift Express, Inc., 256 F.3d at 1342-44.

While neither party addressed the specifics of the grammar separately, each party did address grammar together with logic resulting in differing opinions as to their proposed construction for the disputed claim term. CMO argues that, since the evacuating step requires emptying the gases by pumping down the pressure in the vacuum chamber, and the disposing of the substrate in the first vacuum chamber in a first gaseous material is "at atmospheric pressure," then the disposing must occur prior to evacuating the first and second vacuum chambers. (See CMO's Opening Br. at 23-24).

PPC agrees with CMO regarding the first vacuum chamber, in that the logic of the process dictates that evacuating the chamber should occur after the substrate is disposed in the chamber at atmospheric pressure. (See Markman Hr'g Tr. 219:25 to 220:20). However, the parties part ways regarding the second chamber. (See Markman Hr'g Tr. 220:21 to 226:215).

Both CMO and PPC rely upon the written description and embodiment illustrated by figure 4 of the patent specification to support their opposing construction proposals. (See CMO's Opening Br. at 24-25; PPC's Opening Br. at 25-26; PPC's Opp. Br. at 20-21). CMO argues that the description of the operation requires evacuation of the two chambers after disposing of the substrate. (See CMO's Opening Br. at 24-25; CMO's Opp. Br. at 14). PPC argues that the same language supports its proposal that the evacuating of the second chamber should occur prior to the evacuating of the first chamber and can occur prior to the disposing step. (See PPC's Opening Br. at 25-26; PPC's Opp. Br. at 20-21).

CMO also argues that the internal logic of the other steps immediately following the disposing and evacuating steps also require the specific order. Specifically, CMO argues:

> The plain language and internal logic of the other steps in the claim immediately following steps [3] and [4] also demonstrate that these steps must be performed in their recited order. For example, step [5], which requires "transporting said substrate from said first vacuum chamber to said second vacuum chamber" cannot be perfumed [sic] until after the substrate is disposed in

> said first vacuum chamber in step [3]. Likewise, step [6] logically follows step [5] because it makes no sense to introduce "a second gaseous material . . . into said second vacuum chamber" before the substrate is transported into the second vacuum chamber. Finally, step [7], which requires "applying a glow discharge to a region in said second vacuum chamber to said second gaseous material . . ." must follow the steps of "introducing a second gaseous material . . ." that is performed in step [6].

(CMO's Opening Br. at 24).

PPC agrees that evacuating the second vacuum chamber must occur prior to the transporting and remaining steps but disagrees that such order dictates any other restrictions on performing that step. (See Markman Hr'g Tr. 219:25 to 223:15).

The disagreement between the parties reduces to whether the second vacuum chamber is evacuated at any time after the airlock is closed or only after the remainder of step 3, i.e., disposing of the substrate, is performed. There is no dispute that the logic requires the airlock to be closed prior to evacuating the second vacuum chamber. Otherwise, the gases in the first vacuum chamber would invade the second. The question then becomes, does the evacuation of the second chamber rely upon the completion of any other activity in the steps? The claim language does not dictate it. The order does not dictate it. The written description supports both readings of the order of events or activity. It states at column 6, lines 20 to 25:

> In operation, airlock **61** is closed and the substrate **1** which, for example, are one meter square stainless steel plates, are loaded in chamber **60** and the air is evacuated. Air lock **61** is opened and a commercial feeder mechanism (not shown) moves the, substrate **1** along guide-rail **48** which acts as the electrical connection to ground for substrate **1**."

(See CMO's Exh. 3, the '784 Patent, at col. 6, lns. 20-25 (emphasis added)).

One can easily interpret the written description as pertaining to evacuating the air in both chambers or in the first chamber. Since the passage is susceptible of more than one interpretation, there is no clear intention to limit the scope of the claim language. See Specialty Composites v. Cabot Corp., 845 F.2d 981, 987 (Fed. Cir. 1988) (where specification does not

require limitation it should not be read into the claim). Thus, it would be improper to import the limitation of a specific order of the steps into the claim. See id.

c. CMO's Prosecution History And Specification Argument

CMO also argues that the specification, when viewed in light of the prosecution history, supports its proposed construction. (CMO's Opening Br. at 24-25). Specifically, CMO argues:

> The specification and prosecution history of the '784 patent also demonstrate that the "disposing" step must occur before the "evacuating" step in the claimed invention. During prosecution of the '784 patent, Mr. Coleman explained that claim 21 (then pending as claim 87) was added to "define explicitly" the process "described in the specification" relating to his Figure 4 embodiment, stating:
>
> > New independent claim 87 and dependent claims 88-96 are added to *define explicitly the process described in the specification . . . in connection with Fig. 4*, chambers 60 and 62. More specifically, as illustrated in Fig. 4 *the substrates 1 are disposed in chamber 60 at atmospheric pressure* and the airlock 61 restricts the flow of gas between chamber 60 and 62.
>
> *(See* '784 File History, paper 8 at 5 (Ex. 12) (emphasis added).)
>
> The written description of that process leaves no doubt that steps [3]-[5] must be performed in a particular sequence (*i.e.,* the order recited in the claim). In the described process, the substrates are first loaded into chamber 60 at atmospheric pressure [step 3], the air is evacuated [step 4], and the substrates are then transported from the chamber 60 to the next chamber 62 [step 5]:
>
> > In operation, airlock 61 is closed and the substrate 1 which, for example, are one meter square stainless steel plates, *are loaded in chamber 60* [i.e., step 3] *and the air is evacuated* [i.e., step 4]. Air lock 61 is opened and a commercial feeder mechanism (not shown) moves the, substrate 1 along guide rail 48 [i.e., step 5] which acts as the electrical connection to ground for substrate 1.
>
> *(See* Ex. 3 at 6:19-24 (emphases added).) This specific sequence also is supported by Figure 4, which shows that after leaving chamber 60 a substrate is transported via guide rail 48 through airlock 61 into ohmic-deposition layer chamber 62.
>
> Based on these statements in the specification and prosecution history, it is clear the claim requires that steps [3] and [4] be performed in sequence, *i.e.*, first "disposing" a substrate in a first vacuum chamber at atmospheric pressure (step [3]) before "evacuating" the first and second vacuum chambers (step [4]).

(CMO's Opening Br. at 24-25).

The Special Master rejects CMO's reading of the prosecution history. The most that may be gleaned from CMO's cited portion of the prosecution history is that the Inventor defined explicitly the process in an embodiment. CMO wishes to convert the Inventor's words "define explicitly the process described in the specification" to mean "define explicitly the [order of the steps] described in the specification." (See CMO's Exh. 12, the '784 File History, paper 8 at 5 (emphasis added)). Nothing in the prosecution history supports this interpretation. As for the written description section cited by CMO, it suffers from the ambiguity just pointed out in the prior section, IV.C.4.b. Thus, for the reasons stated herein and in the previous section, IV.C.4.b., the Special Master finds that CMO's argument based upon the prosecution history and specification fails.

d. The Grammar And Internal Logic

The parties are in agreement that the law is clear regarding the issue of required order or sequence in method claims. (See Markman Hr'g Tr. 207:23 to 208:6 (PPC); 212:18-25 (CMO)). Absent directed language in the claim, clear restrictions in the specification or from the prosecution history, order or sequence in the steps of a method claim must derive from the logic or grammar of the claim. See Altiris, Inc. v. Symantec Corp., 318 F.3d 1363, 1369 (Fed. Cir. 2003); Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1342-44 (Fed. Cir. 2001).

As for the grammar of the claim, a list of items, without a prefatory statement that indicates "in the following order" or something similar, is merely a collection of items separated by punctuation (e.g., semi-colons). There being no such prefatory language in Claim 21, no discernible order can be inferred from the sentence structure.

With respect to the logic of Claim 21, certain events or steps must occur prior to other events or steps. For example, a first and second vacuum chamber must be provided in advance of any process that is performed within those chambers. (See CMO's Exh. 3, the '784 Patent, at col. 12, ln. 29). It is necessary to provide an airlock, in said first vacuum chamber, before any evacuation may occur in the first vacuum chamber. (See id. at col. 12, ln. 30; Markman Hr'g Tr. 220:23 to 221:6; PPC's Opening Br. at 25-26; PPC's Opp. Br. at 20-21). The first vacuum chamber needs to be at atmospheric pressure for the disposing of the substrate in the chamber. (See CMO's Exh. 3, the '784 Patent, at col. 12, lns. 31-32; Markman Hr'g Tr. 220:6-20). The airlock must be closed prior to disposing of the substrate at atmospheric pressure and to segregate the first gaseous material from the second vacuum chamber. (See CMO's Exh. 3, the '784 Patent, at col. 12, lns. 31-33; Markman Hr'g Tr. 220:23 to 221:6; PPC's Opening Br. at 25-26; PPC's Opp. Br. at 20-21). Once the airlock is closed, the second chamber may be evacuated, provided that the chamber is evacuated before the airlock is opened. (See Markman Hr'g Tr. 220:23 to 221:6, 275:11-21). Of course, the airlock may be closed at any time, provided disposing of the substrate occurs after the airlock is closed, and provided further that the first vacuum chamber is not evacuated before disposing of the substrate and before the airlock is closed. (See CMO's Exh. 3, the '784 Patent, at col. 12, lns. 29-33, col. 6, lns. 20-22).

Since each vacuum chamber is designed for separate processing, an essential aspect of the Claim, the second vacuum chamber can be evacuated at any time after the airlock is closed provided it is evacuated prior to opening the airlock to receive the substrate (i.e., the transporting step). (See CMO's Exh. 3, the '784 Patent, at col. 12, lns. 29-46; Markman Hr'g Tr. 219:25 to 223:15).

It is also noteworthy that the labels of first and second, in reference to the vacuum chambers or enclosures, is not for the purpose of designating a sequencing of when events occur

within the chamber or enclosures, but rather to distinguish one from the other. (See Markman Hr'g Tr. 276:24 to 278:21).This is further supported by non-asserted dependent Claim 13 that allows for the processing within a "third" vacuum chamber, without reference to a specific order of the processing:

From the '784 patent:

> 13. The method of claim 10 which includes the steps of;
> providing a **third vacuum chamber**;
> disposing said substrate in said **third vacuum chamber** in gas at atmospheric pressure while restricting the flow of said gas at atmospheric pressure **between said third vacuum chamber and said first and second vacuum chambers**;
> evacuating said **third vacuum chamber**; and,
> **transporting said substrate from said third vacuum chamber to one of said first and second vacuum chambers**
> while restricting the flow of gases between said first, second and third chambers.

(See CMO's Exh. 3, the '784 Patent, at col. 11, lns. 18-29 (emphasis added)).

D. "ISOLATING SAID GASEOUS FILM-FORMING MATERIAL IN SAID FIRST VACUUM CHAMBER FROM GASES IN ANY OTHER CHAMBER OF SAID PLURALITY OF VACUUM CHAMBERS"

The parties dispute the meaning of the claim term phrase, "isolating said gaseous film-forming material in said first vacuum chamber from gases in any other chamber of said plurality of vacuum chambers," as contained in Claim number 5 of the '648 Patent. The claim language from Claim number 5 of the '648 Patent, with the disputed claim term phrase highlighted in bold, is reprinted here:

From the '648 Patent:

> 5. A method of making a semiconductor device by forming a film on a substrate using a glow discharge maintained in a first vacuum chamber between first and second electrodes positioned in a face-to-face relation, said first vacuum chamber being one of a plurality of vacuum chambers, said method comprising the steps of:

disposing said substrate on said first electrode;

introducing a gaseous film-forming material comprising silicon and hydrogen from an external source through said second electrode at sub-atmospheric pressure toward said substrate such that said gaseous material flows with a radially outward component of flow over said substrate while **isolating said gaseous film-forming material in said first vacuum chamber from gases in any other chamber of said plurality of vacuum chambers**; and,

maintaining between said electrodes a glow discharge that partially ionizes said gaseous material to form a film comprising silicon and hydrogen on said substrate.

(See CMO's Exh. 4, the '648 Patent, at col. 9, lns. 37-56 (emphasis added)).

1. The Parties' Proposed Constructions

a. PPC's Proposed Construction

PPC argues no construction is necessary. However, if the term phrase is construed, PPC argues that the disputed claim term phrase should be construed such that:

> the gaseous film-forming material introduced into the first vacuum chamber is isolated from gases in any one of multiple vacuum chambers.

(See PPC's Opening Br. at 31).

b. CMO's Proposed Construction

CMO argues that the disputed claim term should be construed such that:

> it includes the requirement that different process gases (i.e., film-forming material) be used in at least two separate processing chambers in which a glow discharge deposition is carried out.

(See CMO's Opening Br. at 35).

2. The Parties' Rationale

a. PPC's Arguments

(1) The plain language of Claim 5 of the '648 Patent is clear requiring no construction for isolating in the disputed term phrase. (See PPC's Opening Br. at 32).

(2) CMO's proposed construction disregards the clear claim language. (See id.)

(3) CMO's proposed construction disregards the Patent specification. (See id. at 32-33).

(4) CMO's proposed construction impermissibly restricts the scope of the claim so that it cannot cover an embodiment expressly disclosed in the specification. (See id. at 33).

(5) CMO misapplies the prosecution history. (See PPC's Opp. Br. at 28-29).

b. CMO's Arguments

(1) The proposed construction is supported by prosecution history disclaimer. (See CMO's Opening Br. at 35-36).

(2) The Inventor, throughout the prosecution history clearly and unambiguously limited the scope of his invention to processes in which different process gases are used in at least two process chambers. (See id. at 36-38).

(3) Unlike PPC's proposed construction, CMO's proposed construction is fully consistent with the specification. (See id. at 39-40; CMO's Opp. Br. at 20 -21).

(4) PPC's proposed construction is inconsistent with the prosecution history. (See CMO's Opening Br. at 40; CMO's Opp. Br. at 20-21).

(5) PPC's claim that CMO's construction reads out an embodiment is wrong. (See CMO's Opp. Br. at 20).

3. The Special Master's Recommended Construction

For the reasons discussed below, the Special Master finds that neither party has provided a proposed construction supported by the record. As such, the Special Master recommends the following construction for the disputed claim term phrase "Isolating Said Gaseous Film-Forming Material in Said First Vacuum Chamber From Gases in Any Other Chamber of Said Plurality of Vacuum Chambers":

> **PREVENTING SAID GASEOUS FILM-FORMING MATERIAL IN SAID FIRST VACUUM CHAMBER FROM BEING MIXED WITH OR CONTAMINATED BY GASES PRESENT IN ANY OTHER CHAMBER OF SAID PLURALITY OF VACUUM CHAMBERS, OR THE ATMOSPHERE, BY CLOSING OFF SAID FIRST VACUUM CHAMBER FROM ANY OTHER CHAMBER OF SAID PLURALITY OF CHAMBERS OR BY CONTROLLING THE PRESSURE WITHIN SAID FIRST VACUUM CHAMBER AND SAID PLURALITY OF VACUUM CHAMBERS TO EXCLUDE SAID GASES FROM SAID FIRST VACUUM CHAMBER**

4. Discussion

a. PPC's "No Construction Necessary" Proposal

PPC's argument that no construction is necessary, which initially appears to be appealing, is incorrect because "isolating" needs to be understood as it functions within the context of the invention. See Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005). "Isolating" can have several meanings depending on its usage. For instance, it can mean: separate placement; set apart; insulate; obtain in free or uncombined state. (See Funk & Wagnalls, New Comprehensive International Dictionary of the English Language, Encyclopedic Edition 676 (1978)). Thus, a plain meaning proposed construction does not fully inform the analysis. See Medrad, Inc. v. MRI Devices Corp., 401 F.3d 1313, 1318-19 (Fed. Cir. 2005) (stating that "claim terms must be interpreted as would one of ordinary skill in the art of [the relevant] technology and in light of the particular patent in suit"); Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1331 (Fed. Cir. 2001) (intrinsic record analyzed for deviation from plain meaning for claim language that is clear on its face); Telemac Cellular Corp. v. Topp Telecom, Inc., 247 F.3d 1316, 1326 (Fed. Cir. 2001) (relying on written description to interpret disputed claim term that did not have a clear and ordinary meaning).

When isolating is viewed within the context of the '648 Patent's intrinsic record, it is clear that the isolating of the gaseous film-forming material in the first vacuum chamber is a separating out or sequestering of that material. (See CMO's Exh. 4, the '648 Patent, at col. 6, lns. 5-10, 20-31). The purpose of isolating (sequestering) the said material in Claim 5, as gleaned from the language of the disputed claim term and the specification, is the prevention of a commingling of gases (that reside in any other vacuum chamber or the atmosphere) with the gaseous film-forming material contained in the first vacuum chamber. (See CMO's Exh. 4, the '648 Patent, at col. 9, lns. 49-51 (disputed claim term language of "isolating" said material from

"gases in any other chamber of said plurality of vacuum chambers"); CMO's Exh. 4, the '648 Patent, at col. 6, lns. 5-10, 20-31 (specification's disclosure of pressure adjustments in exhaust ports to prevent exhaust gases in adjacent compartments from flowing into each other and closure of airlocks to prevent commingling of atmospheric gases)). The reason for avoiding the mixing of these gases with the gaseous film-forming material is to achieve more purity of the film deposited on the substrate and to exercise greater control over the environment within the first vacuum chamber for more efficient processing within that chamber. (See CMO's Exh. 4, the '648 Patent, at col. 6, lns. 5-10, 20-31 (specification's disclosure of preventing commingling of gases); CMO's Exh. 4, the '648 Patent, at col. 6, lns. 10-19 (specification's disclosure of controlling size of chamber and temperature within the chamber); CMO's Exh. 4, the '648 Patent, at col. 6, ln. 37 to col. 7 ln. 5 (specification's disclosure of power supply, pressure and glow discharge within each chamber for the preferred embodiment)).

The Special Master's recommended construction provides the description of what both parties understand the "isolating" function is in the '648 Patent Claim 5. (See CMO's Opening Br. at 34-35 (CMO's acknowledgement that the parties agree that the gaseous film-forming material in the first vacuum chamber must be kept separate from gases in any other vacuum chamber); PPC's Opening Br. at 32 (PPC's recognition that the film-forming gases in the first vacuum chamber are "isolated" from the gases in any other vacuum chamber)). The purpose of "isolating," in the context of the patent, is to preclude commingling of the process gas in the first vacuum chamber with any other gases in the atmosphere or in any of the other vacuum chambers. (See CMO's Exh. 4, the '648 Patent, at col. 6, lns. 5-10, 20-31 (specification's disclosure of pressure adjustments in exhaust ports to prevent exhaust gases in adjacent compartments from flowing into each other and closure of airlocks to prevent commingling of atmospheric gases)). The way the isolating occurs is by an airlock or through pumping down the

exhaust gases to control the pressure in each of the chambers. (See id. (specification's disclosure of pumping down the exhaust gases to prevent exhaust gases in adjacent compartments from flowing into each other and closure of airlocks to prevent commingling of atmospheric gases)).Thus, the Special Master's recommended construction is fully supported by the intrinsic record.

b. PPC's Argument That CMO's Proposed Construction Ignores The Clear Claim Language

PPC asserts that CMO's proposed construction of the disputed claim term phrase disregards the clear claim language of the '648 Patent Claim number 5. (See PPC's Opening Br. at 32). CMO has asserted that the claim language, when viewed through the lens of CMO's reading of the specification and prosecution history, clearly supports CMO's proposed construction. (See CMO's Opening Br. at 32).

The Special Master agrees with PPC regarding the clear language of the claim. There is nothing within the claim language of the'648 Patent Claim number 5 that supports CMO's proposal. In fact, when the language of the '648 Patent Claim number 5 is compared with the language of unasserted claims of the '648 Patent, numbered 15 and 21, it is apparent that the Inventor used "process chamber" to connote that type of vacuum chamber in those claims. For example, the claim language from Claim number 15 of the '648 Patent, with the relevant claim language highlighted in bold, is reprinted here:

From the '648 Patent:

> 15. [A] method of making a semiconductor device by forming a film on a substrate, said method comprising the steps of:
> inserting a plurality of substrates into a **vacuum chamber**;
> closing an airlock in communication with said **vacuum chamber** to isolate said **vacuum chamber** from atmospheric conditions;
> removing one of said plurality of substrates from said **vacuum chamber**;
> rotating said removed substrate about an axis;
> positioning said removed substrate into a selected one of a plurality of

process chambers arranged about said axis;
isolating said selected **process chamber** from other **process chambers** and from said **first vacuum chamber**;
introducing a gaseous film forming material comprising silicon and hydrogen from an external source into said selected **process chamber**; and,
maintaining a glow discharge in said selected **process chamber** that partially ionizes said film forming material to form a film comprising silicon and hydrogen on said removed substrate.

(See CMO's Exh. 4, the '648 Patent, at col. 10, lns. 19-42 (emphasis added)).

The Inventor's use of "vacuum chamber" in the asserted claim and "process chamber" in the unasserted claim provides solid evidence, absent contrary evidence in the intrinsic record, that he intended to use the different labels for a reason. See Symantec Corp. v. Computer Assocs. Int'l, Inc., 522 F.3d 1279, 1289 (Fed. Cir. 2008 (when construing different terms in body of a claim "general assumption is that different terms have different meanings"); Applied Med. Res. Corp. v. United States Surgical Corp., 448 F.3d 1324, 1333 n.3 (Fed. Cir. 2006) (in the absence of contrary evidence the usage of different terms in claims connotes a different meaning). Within the context of the invention, there is no doubt that every process chamber, by virtue of the controlled atmospheric and pressure conditions and processing within said chamber, can be categorized as a vacuum chamber. (See, e.g., PPC's Exh. B, the '648 Patent, title page, second col., "ABSTRACT" (describing the process and control over the processing environment); PPC's Exh. B, the '648 Patent, at col. 2, lns.11-14 (same)). It is also understood that every vacuum chamber is not necessarily a process chamber. (See, e.g., CMO's Exh. 4, the '648 Patent, at col. 10, lns. 19-42 (Claim 15 using each label distinctly); CMO's Exh. 4, the '648 Patent, at col. 6, lns. 20-23 (specification describing non-processing loading (vacuum) chamber)).

These distinctions are important because they provide an answer to the questions raised by the differing views presented by the parties with respect to the specification and the

prosecution history. (See CMO's Opening Br. at 35-40; CMO's Opp. Br. at 20-21; PPC's Opening Br. at 32-33; PPC's Opp. Br. at 28-29).

c. The Parties' Differing Interpretations Of The Patent Specification

PPC asserts that CMO's proposed construction ignores the specifications' disclosure of isolating adjacent chambers that include a loading vacuum chamber containing non-film-forming gas (air or atmosphere outside of the first vacuum chamber) and a vacuum chamber where processing is performed. (See PPC's Opening Br. at 32-33). Specifically, PPC argues:

> The specification discloses isolating adjacent chambers from exhaust gases (Exh. B, '648 Patent at col. 6, lns. 5-10) and from film-forming gases (*id.* at col. 3, ln. 66 - col. 4, ln. 2). Likewise, the specification discloses the evacuation and isolation of chambers containing other non-film-forming gases, such as air. (*Id.* at col. 6, lns. 20-23). Accordingly, the specification discloses, and the claims recite, a method in which at least one vacuum chamber is a loading or unloading chamber (in which the only gas ever present is air), and one or more vacuum chambers are used to performed [sic] glow discharge deposition – and wherein the gases in the deposition chamber are isolated from the air in the loading/unloading chambers. (*See* Exh. A, '784 Patent at col. 5, ln. 64 - col. 6, ln. 22; Fig. 4 (referring to a "loading chamber 60" from which air is evacuated and in which no glow discharge processing is performed)).

(See PPC's Opening Br. at 32-33).

PPC's argument is that CMO's requirement, that "different process gases be used in at least two separate glow discharge deposition processing chambers," ignores the above description in the specification. (See id.) CMO counters that its reading of this part of the specification allows for the configuration that includes the loading chamber (non-processing chamber) provided that it includes at least two separate glow discharge depostiton process chambers containing different process gases. (See CMO's Opp. Br. at 20-21).

CMO, while admitting that the specification does not clearly address "isolating," relies on its reading of an embodiment disclosed in the patent as supportive of its proposed construction. (See CMO's Opening Br. at 39-40). Specifically, CMO argues that:

> Defendants' proposed construction is also fully consistent with the specification, whereas Plaintiffs' proposed construction is not. More specifically, the sole embodiment disclosed in the patent that shows "isolating" process chambers is shown in Figure 4 and described in the accompanying text. As set forth therein, referring to Figure 4, unique, different film-forming gases are introduced into process chambers 62, 63 and 64. (*See* Ex. 4, col. 5, line 64 – col. 6, line 2.) Cross-contamination between these different film-forming gases is prevented by pumping ports 65 and 66, in each of which the pressure is "adjusted to be below that in compartments 62, 63, 64 to ensure that the exhaust gases G do not flow into adjacent compartments." (*See id.*, at col. 6, lines 7-9.) These pumping ports would serve no purpose whatsoever if the same film-forming gas were used in two adjacent chambers.
>
> Moreover, there is no disclosure anywhere in the specification of using the same film-forming gas in two or more of the process chambers shown in Figure 4. Indeed, even in the situation where a thicker film is required, there is no suggestion in the specification of using the same film-forming gas in two or more adjacent chambers and then processing a substrate in both. Rather, to the extent a thicker film is required, the specification expressly teaches increasing the time the substrate remains within the same process chamber (not moving it to an adjacent chamber with the same film-forming gas).

(See CMO's Opening Br. at 39-40).

The Special Master finds that, while CMO presents a compelling argument for its position, it does not address the fundamental distinctions raised by PPC. Specifically, PPC correctly points out that the claim language of the '648 Patent Claim number 5 covers a two chamber system (one loading and one processing) and also a multi-chamber system wherein the other processing chambers contain the same process gases. (See Markman Hr'g Tr. 120:9 to 128:12, 412:11 to 423:4). PPC argues that the multiple chambers wherein each chamber has the same processing gases still must be "isolated" since the stage of processing may not be the same for each chamber. (See PPC's Opp. Br. at 29; Markman Hr'g Tr. 412:11 to 423:4). The foregoing examples refute CMO's arguments regarding the '648 Patent specification.

d. PPC's Assertion That CMO Impermissibly Reads Out A Disclosed Embodiment

As discussed in the previous section, PPC argues that CMO's proposed construction improperly reads out an expressly disclosed embodiment supporting the claim language of the '648 Patent Claim number 5. (See PPC's Opening Br. at 32-33). PPC asserts that:

> The specification discloses isolating adjacent chambers from exhaust gases (Exh. B, '648 Patent at col. 6, lns. 5-10) and from film-forming gases (*id.* at col. 3, ln. 66 - col. 4, ln. 2). Likewise, the specification discloses the evacuation and isolation of chambers containing other non-film-forming gases, such as air. (*Id.* at col. 6, lns. 20-23). Accordingly, the specification discloses, and the claims recite, a method in which at least one vacuum chamber is a loading or unloading chamber (in which the only gas ever present is air), and one or more vacuum chambers are used to performed [sic] glow discharge deposition – and wherein the gases in the deposition chamber are isolated from the air in the loading/unloading chambers. (*See* Exh. A, '784 Patent at col. 5, ln. 64 - col. 6, ln. 22; Fig. 4 (referring to a "loading chamber 60" from which air is evacuated and in which no glow discharge processing is performed)).
>
> The Defendants' proposed constructions impermissibly restrict the scope of the claim so that it cannot cover an embodiment expressly disclosed in the specification – a reading of the claim that would be legally incorrect. *See, e.g., Chimie v. PPG Indus., Inc.*, 402 F.3d 1371, 1377 (Fed. Cir. 2005) (declining to adopt defendant's narrow construction based on the principle that a "construction that would not read on the preferred embodiment would rarely if ever be correct and would require highly persuasive evidentiary support." (citation and quotations omitted)).
>
> Additionally, the term "gases" should be interpreted to have a different meaning, and broader scope, than the more limited "gaseous film forming materials," such that it can also include air, as described above.

(See PPC's Opening Br. at 32-33).

The Special Master finds that CMO's proposed construction does not cover a disclosed embodiment supporting the claim language of the '648 Patent Claim number 5. It is unquestioned that a two-chamber system ("plurality" being more than one), where one of the two vacuum chambers contains non-film-forming gases (e.g., air), satisfies the elements of the claim, i.e., "plurality of vacuum chambers." Likewise, a multiple chamber system (where at least one of

the vacuum chambers processes "a gaseous film-forming material comprising silicon and hydrogen" in accordance with the claim), having more than one processing chamber containing the same process gases, also meets the limitations of the claim. (See CMO's Exh. 4, the '648 Patent, at col. 9, lns. 37-56). No rational reading of the claim language and the specification would permit the Court to rewrite the claim with the limitations that CMO proposes. See Helmsderfer v. Bobrick Washroom Equip., Inc., 527 F.3d 1379, 1383-84 (Fed. Cir. 2008) (stating that courts do not rewrite claims); K-2 Corp. v. Salomon S.A., 191 F.3d 1356, 1364-65 (Fed. Cir. 1999) (same); see also Verizon Servs. Corp. v. Vonage Holdings Corp., 503 F.3d 1295, 1305 (Fed. Cir. 2007) (stating that claim terms should not normally be construed to exclude examples disclosed in the specification); MBO Labs., Inc. v. Becton, Dickinson & Co., 474 F.3d 1323, 1333 (Fed. Cir. 2007) (holding that claim interpretation that excludes a preferred embodiment is rarely correct).

e. PPC's Assertion That CMO Misapplies The Prosecution History

CMO cites numerous examples of the prosecution history, including the initial application filing, response to a final office action rejection, and an appeal brief in the PTO, to support its assertion that the Inventor distinguished his invention on the basis of two or more process chambers using different process gases. (See CMO's Opening Br. at 36-40; CMO's Opp. Br. at 21-22).

PPC attacks CMO's prosecution history disclaimer arguments as going far beyond what the Inventor was presenting to the PTO. (See PPC's Opp. Br. at 28-30). PPC points out that none of the prosecution history citations relied upon by CMO support its position that the Inventor limited the scope of his claims to CMO's proposal. (Id.). Essentially, PPC argues that CMO misapplies the prosecution history. Specifically, PPC asserts that CMO's position that the

Inventor's discussion of multiple chambers isolated from each other and the atmosphere creates an inference that the "isolation" requires at least two processing chambers with different processing gases is just that – an inference. Moreover, most of CMO's citations from the prosecution history include isolating processing gases and the atmosphere. (See CMO's Opp. Br. at 21-22 (CMO's citations of numerous prosecution history examples referring to isolation of gases and the atmosphere)). As such, the isolation is not just limited to process gases. Thus, there is ambiguity in the exclusivity for the object of the "isolating" (i.e., gases and/or atmosphere). CMO's citations also include the Inventor's use of "multi-chamber" or "multiple chamber" processing. Such language does not necessarily mandate "at least two" "processing chambers" using "different processing gases."

During the Markman Hearing, CMO presented 13 prosecution history examples of statements made by the Inventor that CMO relied upon as support for its proposal concerning construction of the disputed term for the '648 Patent, Claim 5. (See Markman Hr'g Tr. 436:4 to 458:21). However, as pointed out by PPC, 11 of the 13 prosecution history examples occurred prior to the existence of the application's Claim that ultimately matured to issue as the '648 Patent Claim number 5. (See Markman Hr'g Tr. 458:21 to 486:18 (emphasis added)). This is important for at least two reasons. First, attributing purported prosecution history Inventor disclaimer statements to the interpretation of a disputed term phrase, for a claim that did not even exist at the time those statements were made, does not inform the analysis. Nor does it comport with the clarity required for such disclaimer. See Honeywell Int'l, Inc. v. Universal Avionics Sys., 493 F.3d 1358, 1365 (Fed. Cir. 2007) (concluding arguments made during prosecution of patent-in-suit were ambiguous and therefore did not limit claim scope); Omega Eng., Inc. v. Raytek Corp., 334 F.3d 1314, 1324-26 (Fed. Cir. 2003) (citing numerous cases refusing to apply prosecution history disclaimer where the asserted disclaimer is not clear and unmistakable).

Second, and more importantly within the context of the '648 Patent and its prosecution history, the 11 pre-existence statements were made in reference to the predecessor application claims that ultimately matured into independent Claims 15 and 21, each of which use language other than vacuum chamber to refer to processing chambers. (See CMO's Exh. 4, the '648 Patent, at col. 10, lns. 20-25 (Claim 15 distinct usage of the terms "vacuum chamber" and "process chamber"); CMO's Exh. 4, the '648 Patent, at col. 11, ln. 3 to col. 12, ln. 16 (Claim 21 usage of the term "process chamber" only); Markman Hr'g Tr. 458:21 to 486:18).

The Special Master finds that CMO's support for its prosecution history argument lacks the clarity for it to be such a broad and sweeping disclaimer. See Honeywell Int'l, Inc., 493 F.3d at 1365; Omega Eng., Inc., 334 F.3d at 1324-26. It is ambiguous, at best, as described above, in that the isolation includes "the atmosphere" and gases. (See CMO's Opp. Br. at 21-22 (CMO's citations of numerous prosecution history examples referring to isolation of gases and the atmosphere)). It lacks the requisite clarity to apply to Claim 5. (See Markman Hr'g Tr. 458:21 to 486:18). It also suffers from a lack of direct disclaimer of the claim language and the written description. See Honeywell Int'l, Inc., 493 F.3d at 1365; Omega Eng., Inc., 334 F.3d at 1324-26. Lastly, it suffers from the failure to account for a disclosed embodiment. (See Section IV.D.4.d., supra).

The Special Master concludes that, on balance, the claim language of the asserted claim and the unasserted claims, the specification, the lack of requisite clarity for disclaimer in the prosecution history, the indirect inferential nature of CMO's prosecution history citations, and the rational reading of the intrinsic record, all provide support for PPC's position that CMO's prosecution history disclaimer argument misapplies the prosecution history to improperly limit the claim. See Honeywell Int'l, Inc., 493 F.3d at 1365; Omega Eng., Inc., 334 F.3d at 1324-26.

E. "ADJUSTING PRESSURE IN SAID FIRST VACUUM CHAMBER TO POSITION SAID GLOW DISCHARGE ABOVE SAID SUBSTRATE"

The parties dispute the meaning of the claim term phrase "adjusting pressure in said first vacuum chamber to position said glow discharge above said substrate" as contained in dependent Claim number 6 of the '648 Patent. The claim language from Claim number 6 of the '648 Patent, with the disputed claim term phrase highlighted in bold, is reprinted here:

From the '648 Patent:

> 6. The method of claim 5, wherein the step of maintaining a glow discharge comprises:
> applying a voltage between said electrodes; and,
> **adjusting pressure in said first vacuum chamber to position said glow discharge above said substrate.**

(See CMO's Exh. 4, the '648 Patent, at col. 9, lns. 57-61 (emphasis added)).

1. The Parties' Proposed Constructions

a. PPC's Proposed Construction

PPC argues that the disputed claim term phrase should be construed as follows:

> The pressure in the vacuum chamber is set, i.e., selected and regulated, to maintain the glow discharge above the substrate.

(See PPC's Opening Br. at 35).

b. CMO's Proposed Construction

CMO argues that the disputed claim term should be construed as follows:

> Changing the pressure in said first vacuum chamber after the glow discharge has been struck to position the glow discharge above said substrate.

(See CMO's Opening Br. at 41).

2. The Parties' Rationale

a. PPC's Arguments

PPC offers the following arguments in support of its proposed construction of the disputed term:

(1) CMO's attempt to impose a temporal limitation lacks support. (See PPC's Opening Br. at 35).
(2) CMO's proposal contradicts the plain language of the disputed claim term phrase and the specification since there is no requirement in the claims or the specification to change the pressure after the glow discharge is struck. (See id. at 36).
(3) CMO misreads the prosecution history. (See PPC's Opp. Br. at 30-31).

b. CMO's Arguments

CMO asserts the following arguments in support of its proposed construction of the disputed term:

(1) The plain language of the claim subsumes the existence of the glow discharge before adjusting the pressure. (See CMO's Opening Br. at 41).
(2) The specification supports CMO's proposed construction (See id. at 41-42).
(3) During the prosecution history the Inventor distinguished a prior art reference on the basis of "fixed pressure" rather than "controlled pressure." (See id. at 42-43).
(4) PPC's proposed construction is contrary to the plain meaning of "adjusting." (See CMO's Opp. Br. at 23).

3. The Special Master's Recommended Construction

For the reasons discussed below, the Special Master finds that neither party has provided a proposed construction supported by the record. While there is no disagreement between the parties regarding where the Glow Discharge should be located (i.e., above the substrate) the parties disagree as to when the Glow Discharge is struck and as to the meaning of adjusting. As such, the Special Master recommends the following construction for the disputed claim term "Adjusting Pressure In Said First Vacuum Chamber To Position Said Glow Discharge Above Said Substrate":

CHANGING THE PRESSURE IN SAID FIRST VACUUM CHAMBER TO CONTROL THE LOCATION OF THE GLOW DISCHARGE SUCH THAT IT OCCURS ABOVE SAID SUBSTRATE

4. Discussion

a. PPC's No Temporal Limitation Argument

PPC cites the specification in refuting CMO's imposition of a timing or ordering of striking the glow discharge before adjusting the pressure. (See PPC's Opening Br. at 35-36). Specifically, PPC points to the automatic regulation of the pressure for the different gases introduced into the vacuum chamber. (See id. at 36; PPC's Exh. B, the '648 Patent, at col. 3, lns. 23-24). PPC also cites a passage of the specification that provides for adjusting the pressure to "0.3 to 0.4 Torr" as being performed prior to the glow discharge "occur[ing]." (See PPC's Opening Br. at 36-37; PPC's Exh. B, the '648 Patent, at col. 3, lns. 48-58). However, CMO cites the same passage with the opposite conclusion, i.e., the glow discharge must exist prior to the adjustment. (See CMO's Opening Br. at 41-42).

The Special Master finds that the relevant passage of the specification is equally susceptible of both interpretations. The specification section provides:

> In operation, the enclosure **6** is evacuated by pump **20** to a pressure below about 0.02 Torr and back-filled with silane (SiH_4) from tank **17*a*** by opening valve **16*a***. Valve **16*a*** is adjusted to maintain the desired pressure in enclosure **6** which, for example, may be ½ Torr. Next a mixture of 10% phosphine (PH_3) in helium (He) from tank **17*b*** is admitted into manifold **15** where it mixes with silane and flows through lines **5**, **7** to raise the system pressure PG to about 1 Torr. The potential difference V between electrodes **2**, **4** is adjusted to about 530 volts initiating a glow-discharge and the current, **I** adjusted to about 5 mA. To produce a heavily dopes [sic] n^+ coating **101** on plate **100**. After maintaining the discharge for about 1 minute, valve **16*b*** is closed to shut off the flow of PH_3 and He leaving silane alone. The uniformity and impurity level of ohmic-layer **101** is not as critical as that of the high-resistivity a-Si layer **10**. Therefore, ohmic-layer **101** may be deposited by conventional doped chemical-vapor-deposition (CVD) or other techniques prior to insertion in apparatus FIG. **1**.

> Next, the pressure PG of silane is adjusted to 0.3 to 0.4 Torr to position a diffuse discharge P in the region above plate **100** and minimize the discharge in the region of closest separation d between electrodes **2**, **4**. The discharge then occurs in the weaker region of the electric-field E as will be discussed in more detail in connection with FIG. ***5b***. The discharge is maintained for 40 minutes at 5 mA with V in the range of 500-700 depending on PG. After desired thickness on substrate **1** is attained, valve ***16b*** is closed and the residual gases evacuated to background by pump **20**. Valve ***16c*** on ammonia (NH_3) tank ***17c*** is opened to admit NH_3 into the substrate region **1** to a pressure of about 400 Torr. A potential difference V is applied between electrodes **2**, **4** of about 350 volts and 1 of 5 mA produce [sic] to a glow discharge adjacent coated substrate **1**. Valve ***16c*** is closed, the residual gases in enclosure **6** evacuated by pump **20**, and the enclosure **6** is backfilled with nitrogen from tank ***17d*** (valve ***16d***) to purge unreacted silane. Valve **13** is closed, jar **6** raised to atmospheric pressure and substrate **1** removed.

(PPC's Exh. B, the '648 Patent, at col. 3, ln. 33 to col. 4, ln. 3 (emphasis added)).

On the one hand, the specification appears to provide for adjusting pressure prior to igniting a glow discharge for the ohmic layer. (See id. at col. 3, lns. 33-44). It also suggests that the ohmic layer can be preprocessed "prior to insertion in the apparatus." (See id. at col. 3, lns. 36-51). The next step discusses adjusting the pressure of the silane "to position a diffuse discharge P in the region above plate **100**," without specifying whether the glow discharge has already been struck or, within the syntax of the sentence will be struck after the pressure adjustment. (See id. at col. 3, lns. 52-55). Thus, there being no mandatory temporal limitation in the claim language itself, and the specification section cited by the parties being susceptible of either interpretation, the Special Master finds that there is no clear or unambiguous support in the claim or the specification for such limitation. See Altiris, Inc. v. Symantec Corp., 318 F.3d 1363, 1369 (Fed. Cir. 2003) (absent clear or implied mandate in claim language or specification or resulting from the grammar and logic of method claim no order or sequence of steps is required); Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1342-44 (Fed. Cir. 2001) (same).

b. PPC's Contradiction Of The Claim And Specification Argument

The Special Master agrees that the claim language does not specifically require the glow discharge to be struck prior to adjusting the pressure. In addition, as discussed in the immediately preceding section, IV.E.4.a., supra, the specification does not provide clear support for such a requirement.

c. PPC's Argument That CMO Misreads The Prosecution History

CMO has cited the Inventor's prosecution history statements distinguishing a prior art reference, the Hough reference ("Hough"), as a prosecution history disclaimer of PPC's proposed construction of setting the pressure before the glow discharge is struck and then regulating it throughout the deposition process. (See CMO's Opp. Br. at 24). PPC counters with the argument that the distinction between Hough and the parent patent, the '897 Patent, concerned controlling the pressure to control where the glow discharge is located within the apparatus rather than Hough's fixed pressure system. (See PPC's Opp. Br. at 31 (emphasis added)). Essentially, PPC is arguing that CMO's assertion of prosecution history disavowal in this context amounts to comparing apples and oranges.

The Special Master finds that PPC's reading of the prosecution history is correct in as much as it provides a distinction between a constant pressure as opposed to an adjusting pressure. The issue of whether disclaiming a fixed pressure negates selecting a pressure point or setting a pressure is less clear. However, when viewed within the context of "fixing," meaning remaining constant and not changing, rather than setting or selecting, within the context of "adjusting," the distinction does make a difference. Disclaiming fixing a constant pressure (thus precluding control over the location of the glow discharge within the apparatus), in favor of controlling the pressure for the purpose of locating the glow discharge in a specific area of the apparatus, does not disclaim selecting a pressure point prior to striking the glow discharge.

It should be noted that, while the Special Master agrees with PPC's reading of the prosecution history regarding the Inventor's distinguishing the invention over the Hough reference, the Special Master does not find that PPC's proposed construction is supported by the claim language or the specification.

d. CMO's Plain Language Of The Claim Argument

CMO argues that the plain language of the claim mandates that the glow discharge must exist prior to positioning it and, hence, prior to adjusting the pressure. (See CMO's Opening Br. at 41). However, the plain language of the claim is ambiguous at best. First, the phrase "maintaining a glow discharge" is described in the '648 Patent Claim number 6, by its explicit claim language, as comprising applying the voltage and adjusting the pressure to "position" or locate the glow discharge above the substrate. It is clear from the language that the act of maintaining is not intended to imply the pre-existence of the glow discharge, since maintaining includes the applying of the voltage between the electrodes.

Second, there being no clear mandate of ordered sequence of the electrical charge and adjusting the pressure, and in light of no specific guidance derived from the grammar and/or logic of the claim, the claim language is broad enough to include adjusting the pressure before, during and/or after the glow discharge is struck. See Altiris, Inc. v. Symantec Corp., 318 F.3d 1363, 1369 (Fed. Cir. 2003) (absent clear or implied mandate in claim language or specification or resulting from the grammar and logic of method claim no order or sequence of steps is required); Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1342-44 (Fed. Cir. 2001) (same).

e. CMO's Specification Argument

CMO argues that the specification supports its proposed construction by pointing to the same written description of an embodiment in the specification that PPC relies upon for PPC's differing proposed construction. (See CMO's Opening Br. at 42-43; PPC's Opening Br. at 36-37). CMO's position fails for several reasons. First, as previously discussed in section IV.E.4.a., supra, the specification lacks clarity in that it is susceptible of either interpretation offered by the parties (i.e., adjusting the pressure before or after striking the glow discharge). Second, assuming that CMO's interpretation of the specification is correct, absent clear language in the claim supporting the limitation, CMO would be impermissibly importing a limitation into the claims from the specification. See Ventana v. Med. Sys., Inc. v. Biogenex Labs., Inc., 473 F.3d 1173, 1181-82 (Fed. Cir. 2006) (federal circuit has "repeatedly warned against confining the claims" to specific embodiments); Collegenet, Inc. v. Applyyourself, Inc., 418 F.3d 1225, 1231 (Fed. Cir. 2005) (specification is examined for context and not to import limitations into the claims); Phillips v. AWH Corp., 415 F.3d 1303, 1323 (Fed. Cir. 2005) (purpose of specification's embodiments is to teach, enable and provide best mode not to provide limitations to confine the claims); Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1326 (Fed. Cir. 2002) (claims must be read in light of specification but not limited by everything expressed in the specification).

f. CMO's Prosecution History Argument

As previously discussed, in section IV.E.4.c., supra, CMO's prosecution history argument is off the mark with respect to the breadth of what was disclaimed by the Inventor's distinguishing the Hough reference from the parent '897 Patent. PPC correctly points out that the Inventor was distinguishing between a fixed or constant pressure process which precludes control over locating the glow discharge in a desired range of the apparatus, and controlling the

pressure for said location control, which is an essential element of the invention. (See PPC's Opp. Br. at 31). CMO equates disclaiming "fixing" with an abstract notion of disclaiming "selecting and regulating." Rather, "fixing" is intended as remaining constant as opposed to changing or adjusting.

g. CMO's Contrary To The Plain Meaning Of "Adjusting" Argument

CMO argues that PPC's proposed construction suggests "setting the pressure to a fixed set point value and then just maintaining the pressure unchanged." (See CMO's Opp. Br. at 23). The Special Master disagrees with CMO and does not interpret the "select and regulate" language of PPC's proposed construction in that manner. Moreover, the act of selecting and regulating can be an act of adjusting or controlling the pressure. Nevertheless, and as previously indicated, the Special Master rejects PPC's proposed "setting" construction and recommends the construction that clearly connotes adjusting (i.e., changing).

h. PPC's Construction Is Contrary To The Claim Language And The Invention

The Special Master finds that PPC's proposed construction is contrary to the claim language and the invention. There is nothing in the claim language of the '648 Patent dependent Claim 6, or independent Claim 5 from which it depends, that dictates one must start at a particular "set" point of pressure. (See PPC's Exh. B, the '648 Patent, at col. 9, lns. 37-61). The most the claim language tells us about the pressure is that it is "sub-atmospheric." (See id. at col. 9, lns. 45-47). The specification provides examples of pressure points and ranges, but they are merely for the particular embodiment. (See id. at col. 3, ln. 19 to col. 4, ln. 3).

"Adjusting," as used in the context of the invention, is changing and controlling rather than "setting." (See PPC's Opp. Br. at 31). In fact, the specification's Abstract and Summary of

the Invention point out that controlling the pressure is an integral part of the invention. (See PPC's Exh. B, the '648 Patent title page, second col., "ABSTRACT"; PPC's Exh. B, the '648 Patent, at col. 2, lns.11-14). Thus, and as provided in the specification, the pressure is continuously being monitored, controlled and adjusted through the introduction of process gases, exhaust pumps and other conditions within the vacuum chamber. (See PPC's Exh. B, the '648 Patent, at col. 3, ln 19 to col. 4, ln. 3).

i. CMO's Construction Is Contrary To The Claim Language

CMO's proposal is also contrary to the claim language and lacking in any clear support from the specification and/or the prosecution history. As discussed previously, with respect to the sequence of steps, in sections IV.E.4.a. and IV.E.4.d., where there is no clear claim language mandating a particular order, the order of the steps of a method claim must be examined in terms of grammar and logic. See Altiris, Inc. v. Symantec Corp., 318 F.3d 1363, 1369 (Fed. Cir. 2003) (absent clear or implied mandate in claim language or specification or resulting from the grammar and logic of method claim no order or sequence of steps is required); Interactive Gift Express, Inc. v. Compuserve, Inc., 256 F.3d 1323, 1342-44 (Fed. Cir. 2001) (same). The grammar of the claim language does not provide any requirement of a specific order since the "applying the electrical charge" and the "adjusting the pressure" are in a conjunctive list of steps preceded by "comprising." See Altiris, Inc., 318 F.3d at 1369; Interactive Gift Express, Inc., 256 F.3d at 1342-44. Similarly, the logic of the claim does not require striking the glow discharge before adjusting the pressure. See Altiris, Inc., 318 F.3d at 1369; Interactive Gift Express, Inc., 256 F.3d at 1342-44. Additionally, since the pressure is continuously monitored, adjusted and controlled, there is no clear mandate from the specification that requires a specific order. (See PPC's Exh. B, the '648 Patent, at col. 3, ln. 19 to col. 4, ln. 3).

CMO argues that there is no need to adjust the pressure to position the glow discharge prior to the existence of the glow discharge. In the first instance, CMO's argument might appear to resonate with the logic of the claim. However, since the goal of adjusting the pressure is to locate the glow discharge above the substrate, logic could equally dictate that one adjust the pressure pre-ignition so that when the glow discharge "occurs" it is in, or close to, the appropriate location. (See, e.g., PPC's Exh. B, the '648 Patent, at col. 3, 52-57 (specification discussing adjusting the pressure so that the discharge "occurs" in the desired location)). Moreover, it is more efficient to prepare the conditions within the chamber prior to the electrical charge (e.g., controlling the pressure) so that the glow discharge "occurs" at the desired location (i.e., above the substrate). (See id.)

The claim language does not require a specific order, the specification is, at best, ambiguous as to the order, and the prosecution history provides no clear disclaimer since the distinction that was made over the Hough prior art addressed the difference between fixed pressure versus the Inventor's controlled pressure for location of the glow discharge. The specification clearly calls out where the glow discharge "occurs." Thus, the intrinsic record supports the recommendation of the Special Master.

F. "A BARRIER LAYER COMPRISING GLOW DISCHARGE DEPOSITED HYDROGENATED NITRIDE OF SILICON AND A METAL OXIDE"

The parties dispute the meaning of the claim term "Barrier Layer" in the claim term phrase "A Barrier Layer Comprising Glow Discharge Deposited Hydrogenated Nitride Of Silicon And A Metal Oxide" as contained in Claim number 5 of the '634 Patent. It should be noted that, while the entire claim term phrase was initially identified as disputed, the parties have reached agreement as to the construction of "Comprising Glow Discharge Deposited

Hydrogenated Nitride Of Silicon." The claim language from Claim number 5 of the '634 Patent, with the disputed claim term highlighted in bold, is reprinted here:

From the '634 Patent:

> 5. A semiconductor device comprising in combination:
> a conductive electrode;
> a layer of hydrogenated amorphous silicon; and,
> a **barrier layer** comprising glow discharge deposited hydrogenated nitride of silicon and a metal oxide interposed between said layer of hydrogenated amorphous silicon and said conductive layer.

(PPC Exh. C, the '634 Patent, at col. 10, lns. 13-19 (emphasis added)).

1. The Parties' Proposed Constructions

a. PPC's Proposed Construction

PPC argues that the disputed claim term should be construed as follows:

> [A] layer which includes both a "metal oxide" layer and a "glow discharge deposited hydrogenated nitride of silicon," and which acts as a barrier between the conductive electrode and the layer of hydrogenated amorphous silicon.

(See PPC's Opening Br. at 43).

b. CMO's Proposed Construction

CMO argues that the disputed claim term should be construed as follows:

> [A] layer that current passes through when the device is working that is a single layer containing both glow discharge deposited hydrogenated nitride of silicon and purposefully, non-incidentally deposited metal oxide.

(See CMO's Opening Br. at 52, 56-57).

2. The Parties' Rationale

a. PPC's Arguments

(1) The barrier layer acts as a barrier to current between the conductive electrode and the layer of amorphous silicon. (See PPC's Opening Br. at 43).

(2) CMO's proposed construction contradicts the embodiments in the specification. (See id. at 44; PPC's Opp. Br. at 39-41).

(3) The prosecution history does not alter the clear teachings of the specification. (See PPC's Opp. Br. at 40).

b. CMO's Arguments

(1) PPC's proposed construction is not supported by the intrinsic evidence. (See CMO's Opening Br. at 56).

(2) The prosecution history supports CMO's proposed construction. (See id. at 56; CMO's Opp. Br. at 31-32).

(3) The specification supports CMO's proposed construction. (See CMO's Opening Br. at 57).

(4) The disputed claim term should be construed in accordance with its understanding in the semiconductor field. (See id. at 57).

3. The Special Master's Recommended Construction

For the reasons discussed below, the Special Master finds that neither party has provided a proposed construction supported by the record. As such, the Special Master recommends the following construction for the disputed claim term "Barrier Layer":

> **A COATING OF MATERIAL THAT SEPARATES THE HYDROGENATED AMORPHOUS SILICON FROM THE CONDUCTIVE LAYER OR ELECTRODE OF A SEMICONDUCTOR DEVICE, WHERE SAID COATING OF MATERIAL IS COMPRISED OF A COATING OF GLOW DISCHARGE DEPOSITED NITRIDE OF SILICON AND AN ADDITIONAL COATING OF A METAL OXIDE**

4. Discussion

a. PPC's Barrier To Current Argument

PPC asserts that the barrier layer "acts as a barrier to current between the conductive electrode and the layer of amorphous silicon." (See PPC's Opening Br. at 43). The Special Master finds that, while this may be part of the function of the barrier layer, it does not adequately capture the interpretation of the disputed claim term within the context of the patent claims.

First, defining the disputed claim term by its own language does not inform the analysis. See Abbott Labs. v. Sandoz, Inc., 544 F.3d 1341, 1360 (Fed. Cir. 2008) (explaining and defining use of words in a claim requires use of words other than the words of the disputed claim term being defined). Specifically, defining barrier as a barrier to current does not explain whether it is functioning as a complete bar to current, or as an impedance or resistance. In fact, for one embodiment, the specification makes it clear that the height of the barrier layer should be limited so it does not "block[ ] the desired charge carriers." (PPC Exh. C, the '634 Patent, at col. 5, lns. 41-42). Second, as admitted by PPC, and as found in the specification, a "barrier layer" can permit the flow of current, albeit in a controlled fashion, depending upon its physical characteristics (e.g., p- or n- , height, thickness, etc.), and/or block the flow of current depending upon the desired application for the semiconductor device. (See Markman Hr'g Tr. 580:7 to 581:16; PPC Exh. C, the '634 Patent, at col. 5, lns. 41-42, col. 8, ln. 66 to col. 9, ln. 11).

b. PPC's Assertion That CMO's Proposed Construction Contradicts The Specification

PPC argues that CMO's proposed construction improperly and narrowly limits the barrier layer to Schottky barrier devices. (See PPC's Opening Br. at 44; PPC's Opp. Br. at 41;

Markman Hr'g Tr. 588:11 to 589:23). PPC points to the FET application, which restricts the flow of charges, and the p-n junction embodiment which differs from the Schottky barrier example. (See Markman Hr'g Tr. 615:6 to 616:25, 656:19 to 660:1; PPC's Opening Br. at 44; PPC's Opp. Br. at 41; PPC Exh. C, the '634 Patent, at col. 5, lns. 41-42, col. 8, ln. 66 to col. 9, ln. 11).

c. PPC's Assertion That The Prosecution History Does Not Alter The Analysis

PPC argues that, contrary to CMO's portrayal of the prosecution history regarding the disputed claim term, nothing in the prosecution history alters the interpretation of the disputed term. (See PPC's Opp. Br. at 40-41). Specifically, PPC refutes CMO's assertion of a single layer that CMO bases upon the Examiner's statement using the word "composite" rather than "compound." (See id. at 40). PPC also counters CMO's argument for a narrow interpretation of "barrier layer" as a tunneling layer that CMO bases upon an ancestor patent (the '804 patent) where the Inventor used the phrase "tunneling barrier layer." (See id. at 41). PPC noted that the Inventor used "barrier layer" in the '634 patent intending something broader than the "tunneling barrier layer " of the '804 patent. (See id.). For the reasons discussed in section IV.F.4.d., infra, the Special Master agrees with PPC's prosecution history argument.

d. CMO's Assertion That PPC's Proposed Construction Lacks Intrinsic Support

CMO asserts that the barrier layer should be interpreted as a single layer. (See CMO's Opening Br. at 56). CMO relies upon the Inventor's characterization of the barrier layer as "compound' and the Examiner's characterization of it as "composite" as support for CMO's assertion. (See id.). CMO also relies upon the same prosecution history excerpt as its basis for

arguing that PPC's proposed construction is not supported by the intrinsic record. (See id.). Specifically, CMO asserts the following:

> Once again, Plaintiffs' proposed construction is not supported by the intrinsic evidence. In particular, during prosecution of the '634 patent, Coleman and the examiner at the Patent Office both characterized the claimed "barrier layer" as *a single layer containing both* hydrogenated nitride of silicon and metal oxide.
>
> For example, when Coleman filed the '634 patent and first introduced claims containing the "a barrier layer" limitation, Coleman asserted that *"[s]uch a compound barrier layer* has the advantages of (a) enhanced barrier and (b) increased dielectric constant when compared to the Carlson devices." ('634 File History, Paper No. 10 at p. 6 (Ex. 35).) In deciding that these claims were patentable, the examiner specifically stated that "[i]t is agreed that the prior art does not suggest *a composite tunneling barrier of a hydrogenated nitride and a metal oxide*." ('634 File History, Paper No. 11 at p. 4 (Ex. 36).) Coleman never disputed this characterization of his claim scope.

(CMO's Opening Br. at 56).

The Special Master finds that CMO's arguments are flawed for several reasons. First, the specification, in describing one of the embodiments, specifically identifies the barrier layer as having two separate and distinct layers. (See PPC Exh. C, the '634 Patent, at col. 5, lns. 37-43 & Fig. 2c; Markman Hr'g Tr. 581:19 to 583:6). The specification's description of the embodiment, illustrated by the Figure 2c drawing in the patent, discloses the following:

> Again, a barrier layer **111** is formed by discharge treatment in ammonia. However, an additional barrier layer **112** is added which may be antimony trioxide (Sb_2O_3) or titanium dioxide (TiO_2) or other metallic oxides or nitrides having a thickness 50 A^0 or less to enhance the barrier height without blocking the desired charge carriers.

(See PPC Exh. C, the '634 Patent, at col. 5, lns. 37-43 & Fig. 2c (emphasis added)).

Second, there is no evidence in the record that "compound" or "composite" is restricted to mean a single construct rather than the combination of more than one component. (See Markman Hr'g Tr. 583:7 to 588:10). Third, the clarity with which one would find an estoppel or disclaimer by prosecution history is non-existent. (See id.); see also Honeywell Int'l, Inc. v.

Universal Avionics Sys., 493 F.3d 1358, 1365 (Fed. Cir. 2007) (concluding arguments made during prosecution of patent-in-suit were ambiguous and therefore did not limit claim scope); Omega Eng., Inc. v. Raytek Corp., 334 F.3d 1314, 1324-26 (Fed. Cir. 2003) (citing numerous cases refusing to apply prosecution history disclaimer where the asserted disclaimer is not clear and unmistakable). Moreover, there is no authority under these circumstances for attributing the Inventor's silence, in the face of the Examiner statement, as acquiescence to, or the basis for, a prosecution history disclaimer. See AquaTex Indus. v. Techniche Solutions, 419 F.3d 1374, 1383 (Fed. Cir. 2005) (no prosecution history estoppel where there was no indication whether inventor agreed or disagreed with the Examiner's characterization of prior art); Salazar v. Procter & Gamble Co., 414 F.3d 1342, 1347 (Fed. Cir. 2005) (holding that an Examiner's statement cannot amend a claim and the applicant's silence in the face of an Examiner's statement will not create prosecution history estoppel or disavowal).

Thus, the Special Master concludes, based upon the intrinsic record, that the barrier layer is composed of two separate layers or coatings: one, a glow discharge deposited hydrogenated nitride of silicon; and, the other, a metal oxide.

e. CMO's Prosecution History Arguments

For the reasons stated in the previous section, IV.F.4.d., supra, the Special Master rejects CMO's prosecution history disclaimer argument.

f. CMO's Assertion That The Specification Supports Its Proposed Construction

CMO argues that the written description supports its proposed construction that the barrier layer means "a layer through which current passes when the semiconductor device is working." (See CMO's Opening Br. at 57). Specifically, CMO asserts that:

> This is clear from the descriptions of the claimed invention in the specification of the '634 patent. (*See* Ex. 5, Figs. 2a, 2b and 2c and the descriptions of those figures at column 4, lines 12-64 and column 5, lines 34-50 clearly indicating that a current from amorphous silicon passes through the barrier layer when the device is working.).

(CMO's Opening Br. at 57).

While the Special Master finds these examples support CMO's argument regarding current passing through the barrier layer, it by no means defines the full scope of the disputed term. As pointed out by PPC, these embodiments are examples and not the only applications for the semiconductor device. (See PPC's Opening Br. at 44; PPC's Opp. Br. at 41; PPC Exh. C, the '634 Patent, at col. 5, lns. 41-42, col. 8, ln. 66 to col. 9, ln. 11). Thus, PPC points to applications where the current is restricted by the barrier layer. (See Markman Hr'g Tr. 656:19 to 660:13; PPC's Opening Br. at 44; PPC's Opp. Br. at 41; PPC Exh. C, the '634 Patent, at col. 5, lns. 41-42, col. 8, ln. 66 to col. 9, ln. 11).

CMO's proposal also ignores the fundamental function of semiconductor devices and attributes a characteristic to the barrier layer that runs counter to the device itself. (See Funk & Wagnalls, New Comprehensive International Dictionary of the English Language, Encyclopedic Edition 1143 (1978) (definition of semiconductor)). Specifically, semiconductor is defined as follows:

> **semiconductor** ***n.*** ***Physics***
> 1. One of a class of crystalline solids, as germane, silicon, and lead sulfide, which are electronic conductors at ordinary temperatures: used in the manufacture of transistors.
> 2. Any substance or material having an electrical conductivity intermediate between metals and dielectrics.

(Id.).

The Special Master concludes that the barrier layer separates other layers of the semiconductor device to facilitate the function of the semiconductor device for its intended

application. Otherwise the barrier layer would not be necessary and the conductive layer or conductive electrode could be directly connected to, or in direct contact with, the hydrogenated amorphous silicon which is contrary to the plain language of the claim and the inventive features of the '634 patent. (See PPC Exh. C, the '634 Patent, at col. 10, lns. 10-19 (Claim 5); title page, second col., "ABSTRACT"; col. 2, lns. 6-31; col. 8, ln. 66 to col. 9, ln. 11). Moreover, the meaning of a disputed claim term should ordinarily be construed to align with the purpose of the patented invention. See Markman v. Westview Instruments, Inc., 517 U.S. 370, 389 (1996) ("term can be defined only in a way that comports with the instrument as a whole"); Phillips v. AWH Corp., 415 F.3d 1303, 1316 (Fed. Cir. 2005) (correct construction "stays true" to claim language and "most naturally aligns" with patent's description); Merck & Co v. Teva Pharms. USA, Inc., 347 F.3d 1367, 1371 (Fed. Cir. 2003) (claims must be construed consistent with specification); Reinshaw PLC v. Marposs Societa' Per Azioni, 158 F.3d 1243, 1250 (Fed. Cir. 1998) (persuasive claim construction "defines terms in the context of the whole patent").

g. CMO's "Understanding In The Semiconductor Field" Argument

CMO posits the Schottky barrier definition, citing "The Authoritative Dictionary of IEEE Standards Terms 1008 (2000)," and one of the objects of the invention being "to form a Schottky barrier," as support for limiting the barrier layer to that definition. (See CMO's Opening Br. at 57). For the reasons stated in the previous sections, IV.F.4.a. to IV.F.4.f., supra, the Special Master also rejects this basis for CMO's proposed limitation.

h. The Special Master's Use Of "Coating" And "Material"

The Special Master finds support in the intrinsic record for his "coating of material" construction for the "layer" component of the disputed term. Specifically, the Inventor refers to "coating" and "material" numerous times throughout the patent specification. Moreover, in the Abstract and the Summary of the Invention, the Inventor refers to the various layers in terms of

"coatings" and "material." (See PPC Exh. C, the '634 Patent, title page, second col., "ABSTRACT"; col. 2, lns. 6-31).

G. "A BARRIER LAYER COMPRISING GLOW DISCHARGE DEPOSITED HYDROGENATED NITRIDE OF SILICON AND A METAL OXIDE"

The parties dispute the meaning of the claim term "Metal Oxide" in the claim term phrase "A Barrier Layer Comprising Glow Discharge Deposited Hydrogenated Nitride Of Silicon And A Metal Oxide" as contained in Claim number 5 of the '634 Patent. It should be noted that, while the entire claim term phrase was initially identified as disputed, the parties have reached agreement as to the construction of "Comprising Glow Discharge Deposited Hydrogenated Nitride Of Silicon." The claim language from Claim number 5 of the '634 Patent, with the disputed claim term highlighted in bold, is reprinted here:

From the '634 Patent:

> 5. A semiconductor device comprising in combination:
> a conductive electrode;
> a layer of hydrogenated amorphous silicon; and,
> a barrier layer comprising glow discharge deposited hydrogenated nitride of silicon and a **metal oxide** interposed between said layer of hydrogenated amorphous silicon and said conductive layer.

(PPC Exh. C, the '634 Patent, at col. 10, lns. 13-19 (emphasis added)).

1. The Parties' Proposed Constructions

a. PPC's Proposed Construction

PPC argues that the disputed claim term should be construed as follows:

> [It] includes both metal oxides as well as other metallic oxides.
>
> -or alternatively-
>
> [It] should be construed to mean "a compound formed by the combining of oxygen atoms and metallic atoms (as defined by the Periodic Table: IA, IIA, IB~VIIIB, IIIA: Al, Ga, In, TL; IVA: Si,

Ge, Sn, Pb; VA: As, Sb, Bi; VIA: Se, Te, Po) by covalent bonds[.]"

(See PPC's Opening Br. at 42; The Parties' Joint Claim Construction Chart [revised 10/13/10] at 3).

b. CMO's Proposed Construction

CMO argues that the disputed claim term should be construed as follows:

> A binary compound of metal and oxygen that has been purposefully, non-incidentally deposited on the substrate.

(See CMO's Opening Br. at 52; The Parties' Joint Claim Construction Chart [revised 10/13/10] at 3).

2. The Parties' Rationale

a. PPC's Arguments

(1) The Inventor was acting as his own lexicographer. (See PPC's Opening Br. at 42-43; Markman Hr'g Tr. 571:15 to 573:3).

(2) The inclusion of a metal and a metallic substance in the specification example supports its construction. (See PPC's Opening Br. at 43; PPC's Opp. Br. at 37-38).

(3) There is no support for CMO's assertion of purposeful, non-incidental deposit of oxygen. (See PPC's Opp. Br. at 38).

b. CMO's Arguments

(1) The Inventor was not acting as his own lexicographer. (See CMO's Opp. Br. at 30-31).

(2) PPC's assertion that metal includes metalloid is not supported by the intrinsic record. (See CMO's Opening Br. at 55; CMO's Opp. Br. at 30-31).

(3) The specification supports CMO's proposed construction (i.e., purposefully and non-incidentally deposited). (See CMO's Opening Br. at 53-54; CMO's Opp. Br. at 29).

(4) The prosecution history supports CMO's proposed construction (i.e., purposefully and non-incidentally deposited). (See CMO's Opening Br. at 54-55; CMO's Opp. Br. at 29-30).

3. The Special Master's Recommended Construction

For the reasons discussed below, the Special Master finds that neither party has provided a proposed construction supported by the record. As such, the Special Master recommends the following construction for the disputed claim term "Metal Oxide":

A COMPOUND OF A METAL AND OXYGEN, WHERE SAID METAL CAN BE A METAL OR METALLOID

4. Discussion

a. PPC's Assertion That The Inventor Was Acting As His Own Lexicographer

PPC argues that the Inventor used the term "metal oxide" to ascribe a special meaning to the term that includes metallic oxide. (See PPC's Opening Br. at 42-43; Markman Hr'g Tr. 571:15 to 573:3). CMO counters that the sections of the specification that PPC relies upon do not support its assertion of unique lexicography. (See CMO's Opp. Br. at 30-31).

The question of whether the Inventor intended to be his own lexicographer by using the disputed term "metal oxide" to include metallic elements and metals is a close one. The Special Master concludes that each of the parties' arguments is partially correct. The Special Master agrees that an Inventor can be his/her own lexicographer, but finds that it is not the case with respect to the disputed term, "metal oxide," in the '634 Patent. There is no clarity in the record that unique lexicography was intended by the Inventor. See Golight, Inc. v. Wal-Mart Stores, Inc., 355 F.3d 1327, 1332 (Fed. Cir. 2004) (stating that a patentee may define a term as his own lexicographer if he does so "with reasonable clarity, deliberateness, and precision"); Abbott Labs. v. Syntron Bioresearch, Inc., 334 F.3d 1343, 1354 (Fed. Cir. 2003) (same). The record cited by PPC does not support a finding that the Inventor was acting as his own lexicographer. However, it is not necessary to reach that conclusion and still find that the "metal oxide"

includes "metallic oxide." A finding of specific lexicography is not necessary since the specification includes a metal and a metalloid.

CMO has pointed out that the specification does not include the term "metal oxide" but rather discloses "metallic oxide" including the examples of a metal and a metalloid. (See CMO's Opp. Br. at 30-31; PPC Exh. C, the '634 Patent, at col. 5, lns. 37-41 (specification disclosure of titanium (metal) and antimony (metalloid))). Under these circumstances, there are potentially four interpretations for the disputed term: only metals, only metalloids, both or neither. Neither can be eliminated since such interpretation ignores the claim term that was used, i.e., metal oxide. Restricting the disputed term to all metalloids and no metals impermissibly discards one class of disclosed examples, i.e., metals, like titanium; and, restricting the disputed term to all metals and no metalloids impermissibly discards the other class of disclosed examples, i.e., metalloids, like antimony. (See PPC Exh. C, the '634 Patent, at col. 5, lns. 37-41 (specification disclosure of titanium (metal) and antimony (metalloid)). Thus, the resulting conclusion is that the Inventor intended both to be included.

While it is ambiguous at best whether the Inventor acted as his own lexicographer and included both metals and metalloids with the disputed term "metal oxide," there is ample additional support for the conclusion that both were intended to be included irrespective of resolving the Inventor's lexicography issue. First, turning to a dictionary for guidance, as is permissible when the intrinsic record is ambiguous, we find that a metal includes metallic substances and vice versa. See Phillips v. AWH Corp., 415 F.3d 1303, 1318 (Fed. Cir. 2005) (holding that dictionaries may be used to assist the court in "determining 'the true meaning of language used in the patent claims'"). The dictionary defines metal in terms of its "metallic" properties. (See Funk & Wagnalls, New Comprehensive International Dictionary of the English Language, Encyclopedic Edition 800 (1978)). Specifically, metal is defined as follows:

metal ***n.***

1. An element that forms a base by combining with a hydroxyl group or groups. It is usually hard, heavy, lustrous, malleable, ductile, tenacious, and a good conductor of heat and electricity.

2. A composition of some metallic element; also, an alloy: generally with a qualifying word.

(Id. (emphasis added)).

Likewise, metallic is defined, in terms of "metal" properties, as follows:

metallic ***adj.***

1. Being, containing, yielding, or having the characteristics of a metal: a *metallic* voice; *metallic* luster.

2. Pertaining to a metal.

(Id. (emphasis added)).

Similarly, metalloid is defined as follows:

metalloid ***n.***

1. One of those non-metallic elements that resemble the metals in some of their properties, as arsenic and antimony.

– ***adj.***

1. Resembling a metal.

2. Of, pertaining to, or having the Properties of a metalloid.

(Id. (emphasis added)).

Second, while reliance upon judicial construction of disputed phrases involving unrelated patents is frowned upon (since the inventor can always be his/her own lexicographer), it may be instructive in patent cases where the terms have been used as synonyms (and there is no apparent attempt by the inventor to be his/her own lexicographer) or where the terms are used interchangeably in non-patent cases (e.g., customs tariff cases). See, e.g., Durel Corporation, v. Osram Sylvania Inc., 256 F.3d 1298, 1304 (Fed. Cir. 2001) (interpreting metal oxide for claim construction by citing dictionary definitions that describe "oxide" as a "'binary chemical compound in which oxygen is combined with a metal" and as a "'mineral in which metallic atoms are bonded with oxygen atoms'") (emphasis added); Terrazzo & Marble Supply Co. v.

United States, 30 Cust. Ct. 202, 212 (Cust. Ct. 1953) (customs tariff classification of goods case describing the manufacturing of colored glass using metal oxide and metallic oxide interchangeably) (emphasis added).

A particularly instructive case regarding the relationship between metal oxide and metallic oxide is In re Mond's Appeal, 16 App. D.C. 351 (D.C. Cir. 1900). The In re Mond's Appeal case is an appeal from a decision of the Commissioner of Patents rejecting a patent application where the appeals court referred to a specific "metal oxide" (zinc oxide) as a singular form of "metallic oxides." See id. at 353. Specifically the appeals court held:

> If a process for the reduction of any and all metallic oxides is not patentable, it is difficult to say how the same process for one specific metal oxide, the oxide of zinc, can be patentable. The whole necessarily includes the part. The genus includes the species. No great insistence seems to be made on this point before us, and we must hold that it is not tenable.

Id. (emphasis added).

Third, it would run afoul of the purpose of the claim itself, i.e., the context of the claim (a semiconductor device) to preclude metalloids since they are considered to have semiconductor characteristics. See Phillips v. AWH Corp., 415 F.3d 1303, 1316 (Fed. Cir. 2005) (stating that disputed term should be construed in the context of the entire patent). Moreover, the meaning of a disputed claim term should ordinarily be construed to align with the purpose of the patented invention. See Markman v. Westview Instruments, Inc., 517 U.S. 370, 389 (1996) ("term can be defined only in a way that comports with the instrument as a whole"); Phillips, 415 F.3d at 1316 (correct construction "stays true" to claim language and "most naturally aligns" with patent's description); Merck & Co v. Teva Pharms. USA, Inc., 347 F.3d 1367, 1371 (Fed. Cir. 2003) (claims must be construed consistent with specification); Reinshaw PLC v. Marposs Societa' Per Azioni, 158 F.3d 1243, 1250 (Fed. Cir. 1998) (persuasive claim construction "defines terms in the context of the whole patent").

b. PPC's Inclusion Of Both A Metal And A Metalloid Example In The Specification

PPC asserts that the inclusion of antimony trioxide, a metalloid oxide, and titanium oxide, a metal oxide, in the specification, supports its proposed construction. (See PPC's Opening Br. at 43; PPC's Opp. Br. at 37-38). Specifically, PPC points out:

> The examples provided include titanium dioxide and antimony trioxide. Those of ordinary skill in the art would understand that titanium is a metal, while antimony is a "metalloid"/metallic substance (*i.e.*, those substances having properties between those of metals and non-metals). (*See* Exh. K, Webster's New Collegiate Dictionary at 722 (1977)). Innolux and AUO appear to agree with Plasma – Innolux accepts that the claimed metal oxide can be sufficiently broad to include "metal *or metalloid[s]*," and AUO's specific recitation of categories of elements from the Periodic Table of Elements includes various metalloids, such as Ge, As, Sb, and Te, in the definition as "metallic." (*See* Exh. D, Joint Claim Construction Chart, No. 24). Accordingly, because the patentee when referring to this barrier layer in the specification defined this metal oxide portion of the barrier layer as also including "metallic oxides," such as the metalloid oxide in the specification, the metal oxide of claim 5 of the '634 Patent should be read sufficiently broadly to include both metal oxides and metallic oxides (such as metalloid oxides). Any construction excluding metalloid oxides would contradict the specification, and this would be improper. *See, e.g., Vitronics,* 90 F.3d at 1583.

(See PPC's Opening Br. at 43).

CMO argues that, by disclosing both metals and metalloids and using the term "metal oxide," the metalloids should be considered dedicated to the public as disclosed yet unclaimed. (See CMO's Opening Br. at 55; CMO's Opp. Br. at 30-31). CMO specifically states that:

> [E]ven if the term "metallic oxide" had a broader or different range from the term "metal oxide," by disclosing it in the specification but not using the term in the claims, the patentee waived his right to such claim scope, and cannot recapture it now through claim construction. *See PSC Computer Prods., Inc. v. Foxconn Int'l*, 355 F.3d 1353, 1360 (Fed. Cir. 2004) (holding that subject matter that is disclosed in the specification but not claimed is dedicated to the public and cannot be recaptured).

(See CMO's Opening Br. at 55).

While disclosure of subject matter in the specification without claiming it can result in its dedication to the public, those instances arise where the disclosure is an alternative to what is claimed; hence, there is no arguable claim to the disclosed subject matter. See Pfizer, Inc. v. Teva Pharmaceuticals USA, Inc., 429 F.3d 1364, 1378-79 (Fed. Cir. 2005) (holding that to be deemed as dedicated to the public unclaimed subject matter must be identified by the patentee "as an alternative to a claim limitation") (emphasis added); PSC Computer Prods., Inc. v. Foxconn Int'l, Inc., 355 F.3d 1353, 1359-60 (Fed. Cir. 2004) (holding that specific disclosure of molded plastic parts used in prior art devices as an alternative to metal parts was dedicated to the public where claim was only for metal parts) (emphasis added). This is because there is clarity of exclusion, by disclosure of the subject matter as an alternative to the claim limitation, thus, supporting the negative inference. See PSC Computer Prods., Inc., 355 F.3d at 1359-60.

The distinction between the type of disclosure that does not satisfy the disclosure-dedication rule and the type of disclosure that does satisfy the rule is clearly described in PSC Computer Prods., Inc. Specifically, the court pointed out that:

> This "disclosure-dedication" rule does not mean that any generic reference in a written specification necessarily dedicates all members of that particular genus to the public. The disclosure must be of such specificity that one of ordinary skill in the art could identify the subject matter that had been disclosed and not claimed. . . .The passages that the district court identified in the '239 written description illustrate both generic and specific disclosures. We agree with PSC that the *generic* disclosure that "other resilient materials may be suitable for the strap," *'239 patent*, col. 4, ll. 50-51, did not dedicate all resilient materials other than stainless steel to the public. We agree with the district court, however, that the *specific* disclosure that "other prior art devices use molded plastic and/or metal parts that must be cast or forged which again are more expensive metal forming operations," *Id.*, col. 2. ll. 39-41, dedicated the alternative use of plastic parts to the public. A reader of ordinary skill in the art could reasonably conclude from this language in the written description that plastic clip parts could be substituted for metal clip parts. PSC was thus obliged either to claim plastic parts in addition to metal parts and to submit this broader claim for examination, or to not claim them and dedicate the use of plastic parts to the public. The *'239 patent*'s claims and written description thus combined to put the public on notice that clips made of metal parts would infringe, while those made of plastic parts

would not. The district court in essence concluded that that one of ordinary skill in the art would be compelled to read the written description to establish that plastic parts may serve as an alternative to the metal parts in the claim.

PSC Computer Products, Inc., 355 F.3d at 1360.

Here, rather than identifying a generic category or specific materials used in the prior art as an alternative for what is claimed, the Inventor specifically pointed out examples of what is claimed. Thus, the Special Master finds that, by virtue of the synonymous relationship between metal and metallic (as discussed previously in section IV.G.4.a., supra) and the Inventor's inclusion in the specification of metals and metalloids as examples of metallic oxides, it is clear that the Inventor's disclosure was not an alternative to the claim limitation. See Pfizer, Inc., 429 F.3d at 1378-79; PSC Computer Prods., Inc., 355 F.3d at 1359-60. Moreover, the disclosure describes that which is claimed (i.e., "metallic/metal oxides").

c. CMO's Proposed Purposeful, Non-Incidental Deposited Oxygen Limitation

CMO devoted much of its arguments in its briefs and at the Markman Hearing, concerning its proposed construction limitation of purposeful non-incidental deposited oxygen, in reliance upon the specification and the prosecution history of the related family of patents. (See CMO's Opening Br. at 53-55; CMO's Opp. Br. at 29-30; Markman Hr'g Tr. 607:9 to 614:22). For example, regarding the specification, CMO argues:

> First, the specification of the patent-in-suit discloses that "[a] barrier layer 112 is added which may be antimony trioxide (Sb_2O_3) or titanium dioxide (TiO_2) or other metallic oxides or nitrides . . . ." (*See* Ex. 5, col. 5, lines 22-26.) As is well known by those skilled in the art, both antimony (Sb) and titanium (Ti) only undergo oxidation at very high temperatures, not room temperature. This plainly undercuts Plaintiffs' assertion that the "oxide" in the claimed "metal oxide" can arise "naturally . . . between manufacturing process steps."
>
> The specification of the patent-in-suit also discloses that a substrate having a metal film thereon should not be exposed to the atmosphere. For example, with reference to Figure 4, the specification teaches that the substrate should be moved *directly* from ohmic-layer deposition chamber 62 to amorphous silicon glow

discharge process chamber 63 without any possible exposure to the air or an oxygen-containing atmosphere. (*See* Ex. 5, col. 5, line 62 to col. 6, line 16.)

(See CMO's Opening Br. at 53-54).

With respect to the prosecution history of related patents, CMO argues:

> Second, the prosecution history of Coleman's related patents also shows that Plaintiffs' proposed construction is incorrect. More specifically, throughout prosecution of the patents in this family, Coleman repeatedly asserted that his system of glow discharge process chambers reduced contamination of the various films by, *inter alia*, air from the external atmosphere.
>
> For example, during prosecution of the '648 patent, Coleman asserted to the examiner at the Patent Office that:
>
> > *Applicant's process, which includes multiple chambers that are isolated from external atmospheres, substantially reduces the contamination.* Applicant's process is unique and provides significant unexpected advantages compared to the closest prior art.
>
> ('648 File History, paper 2 at p. 8 (Ex. 22) (emphasis added).) Similarly, later during prosecution of the same patent, Coleman argued that "the present specification in connection with FIG 4 describes *a separate airlock chamber 60 for removing atmospheric gases from the substrate . . . because, as discussed above, such gases may act as impurities during the glow discharge processing steps*." ('648 File History, Paper No. 11 at p. 15 (Ex. 21).) Likewise, Coleman asserted that "the method of the present invention utilizes *multiple processing chambers which are isolated from* each other and *the atmosphere*." ('648 File History, Paper No. 38 at p. 4 (Ex. 19).)
>
> In view of these clear and unequivocal statements, Plaintiffs' proposed construction cannot be correct. The public is entitled to rely on Coleman's repeated assertions that his invention required keeping the substrate isolated from and free of the external atmosphere. Plaintiffs' proposed construction, which encompasses oxidation of a metal layer due to exposure to atmospheric oxygen, is contrary to these assertions and should therefore be rejected.

(See CMO's Opening Br. at 54-55).

PPC disputes CMO's reading of the specification regarding CMO's "purposeful, non-incidental limitation." (See PPC's Opp. Br. at 38). PPC specifically argues:

> Next, the Defendants each propose some variant of a definition requiring the "purposeful, non-incidental" inclusion of a metal oxide in the claimed device.

> (Defendants Br. at 52). For all of the reasons expressed previously, there is no justification for importing such a limitation into the claims of any patent, and particularly not the '634 Patent. For example, the Defendants indicate – without any support – that "[a]s is well known by those skilled in the art, both antimony (Sb) and titanium (Ti) only undergo oxidation at very high temperatures, not room temperature." (Defendants' Br. at 53). The statement is incorrect for at least two reasons – first, because oxygen does form on at least titanium at ultra low pressures, and second because the substrates in question are not at "room temperature," but are heated inside the process chamber. (*See, e.g.,* Exh. C, '634 Patent at col. 6, lns. 28-35).

(PPC's Opp. Br. at 38).

PPC also argues that CMO's reliance upon the prosecution history is misplaced since the prosecution history is from a related family patent covering processes rather than devices. (See id.). PPC specifically noted:

> The Defendants also attempt to rely on prosecution history in connection with other inventions – which relate to processes – even though the '634 Patent does not claim any process. (Defendants' Br. at 54). This reliance is misplaced for two reasons. First, "each claim does not necessarily cover every feature disclosed in the specification. When the claim addresses only some of the features disclosed in the specification, it is improper to limit the claim to other, unclaimed features." *Ventana,* 473 F.3d at 1181. Moreover, the prosecution history statements cited by Defendants fail to even mention or relate to the term metal oxide, and hence cannot meet the high standard for finding a disclaimer of claim scope. *Honeywell Int'l,* 493 F.3d at 1365; *see Invitrogen Corp. v. Clontech Labs., Inc.,* 429 F.3d 1052, 1078 (Fed. Cir. 2005) (prosecution in parent application will generally not limit different language in continuation applications).

(PPC's Opp. Br. at 38).

The Special Master finds that there is nothing in the intrinsic record to support the "purposeful, non-incidental" limitation proposed by CMO. Beginning with the claim language itself, as we must, it is beyond question that the disputed claim term is part of a claim directed to a device rather than a process or product by process. See Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996) (claim interpretation begins with the language of the claim); In re Nuijten, 500 F.3d 1346, 1354-57 (Fed. Cir. 2007) (comparing the characteristics of the four different categories of patentable subject matter). The claim language clearly states "comprising .

. . and a metal oxide." (See PPC Exh. C, the '634 Patent, at col. 10, ln. 12). The claim language specifically calls out, by its preamble language that begins with "[a] semiconductor device," that it is a device claim and not a method or process claim. (See id.). As such, unless specifically required by the claim language, as with "glow discharged nitride of silicon," the process by which the metal oxide is formed is NOT an element of the claim. See In re Nuijten, 500 F.3d at 1354-57 (comparing the characteristics of the four different categories of patentable subject matter).

An examination of the specification and prosecution history of the related method patent (the '648 Patent) does not alter the analysis. First, if the disputed claim term was part of a method claim, or product by process claim, perhaps the issue might resolve in favor of CMO's proposal. However, as previously stated, the disputed claim term is part of a device claim. Second, carrying forward CMO's arguments would require impermissibly importing its asserted process limitations connected with method claims in a method patent into the device claim of a related but distinct device patent. See Invitrogen Corp. v. Clontech Labs., Inc., 429 F.3d 1052, 1078 (Fed. Cir. 2005) (holding that the prosecution of a claim term in a parent application "will generally not limit different claim language in a continuation application"); Biogen, Inc. v. Berlex Labs., 318 F.3d 1132, 1141 (Fed. Cir. 2003) (stating that "[w]hen the applicant is seeking different claims in a divisional application estoppel generally does not arise from the prosecution of the parent"). Thus, the Special Master finds that the metal oxide can be, but need not necessarily be, in a purposefully and non-incidentally oxidized form.

The Special Master also finds it necessary to point out to the parties that their assertion, that certain disputed terms be construed the same for all three of the patents-in-suit, has the unintended consequence of confusing the process of claim interpretation. Cf. Middleton, Inc. v. Minnesota Mining & Mfg. Co., 311 F.3d 1384, 1387 (Fed. Cir. 2002) (stating that meaning of

patent term "is not subject to revision or alteration by subsequent contract between the patentee and its suppliers"). It is true that the patents are in a related family of patents that share a common specification and ancestor patent. However, in an attempt to possibly simplify the process, certain realities could be ignored or overlooked. Each patent and its claims stand on its own. See Invitrogen Corp., 429 F.3d at 1078; Biogen, Inc., 318 F.3d at 1141. Each patent's prosecution history also stands on its own unless clearly referencing the claims or intrinsic elements of the other related patents for incorporation, disclaimer or description. See Invitrogen Corp., 429 F.3d at 1078; Biogen, Inc., 318 F.3d at 1141. Any overlapping of prosecution history from one patent to another related patent must be clearly divined. See Invitrogen Corp., 429 F.3d at 1078.

While the parties may have agreed between themselves that the same interpretation should apply across the three patents-in-suit, such stipulation cannot overcome the reality and public notice function of the patents. Cf. Phillips v. AWH Corp., 415 F.3d 1303, 1319 (Fed. Cir. 2005) (recognizing public notice function of patents); AK Steel Corp. v. Sollac, 344 F.3d 1234, 1243 (Fed. Cir. 2003) (different construction for two similar claims in related patents sharing the same specification compelled by the relevant facts). Also, while the '648 and '784 Patents share a common specification, and the '634 Patent has a substantially similar specification, different claims, and different claim types (e.g., device versus method claims) must be interpreted on that basis. See In re Nuijten, 500 F.3d 1346, 1354-57 (Fed. Cir. 2007) (comparing the characteristics of the four different categories of patentable subject matter). Despite the inferences that may be drawn from the prosecution history and specification that may be clear and applicable to the method claims of the related patents, the lack of clarity and applicability to the device claims cannot be ignored. See Omega Eng., Inc. v. Raytek Corp., 334 F.3d 1314, 1324-26 (Fed. Cir. 2003) (citing numerous cases refusing to apply prosecution history disclaimer where the asserted

disclaimer is not clear and unmistakable). The device claims, unless otherwise stated by the claim, merely recite elements that must exist and/or function in the device within the context of the claim. See In re Nuijten, 500 F.3d at 1354-57.

Thus, the Special Master finds, with respect to the disputed term "metal oxide," CMO's citation of the common specification, and of the prosecution history of the '648 method patent, does not support its proposed limitation of "purposeful, non-incidental deposited oxygen."

V. CONCLUSION

For all of the foregoing reasons and authorities, the Special Master reports and recommends that the parties' claim construction disputes be resolved as stated herein.

Dated: May 18, 2010

ROBERT J. RANDO, ESQ.,
SPECIAL MASTER

APPENDIX 'A'

TABLE: DISPUTED CLAIM TERMS, PARTIES' PROPOSED CONSTRUCTIONS AND THE SPECIAL MASTER'S RECOMMENDED CONSTRUCTIONS

THE DISPUTED CLAIM TERMS	**PPC'S PROPOSED CONSTRUCTIONS**	**CMO'S PROPOSED CONSTRUCTIONS**	**THE SPECIAL MASTER'S RECOMMENDED CONSTRUCTIONS**
A. *GLOW DISCHARGE*	"Glow discharge" is a PECVD glow discharge created by ionization in an electric field of film producing gaseous materials from a source external to the enclosure or chamber.	"Glow discharge" is an electric discharge through a gas that is generated using electric power and frequency levels lower than those required to break down pure nitrogen.	**A luminous transient or continuous conduction of electricity through a gas by the formation and movement of electrons and ions in a controlled pressure and electric field utilized in connection with plasma enhanced CVD processing.**
B. *EVACUATING SAID FIRST AND SAID SECOND VACUUM CHAMBERS*	No construction is necessary. Alternatively, if the term is construed: "evacuating" the vacuum chamber is pumping the gas therein to be substantially lower than the operating pressure in that chamber.	Emptying the gases from the first and second chambers, for example, by pumping down the pressure in the chamber to not more than .02 Torr.	**Emptying the gases from the vacuum chambers by pumping down the pressure in each chamber.**
C. *SEQUENCE OF THE STEPS: DISPOSING A SUBSTRATE IN SAID FIRST VACUUM CHAMBER IN A FIRST GASEOUS MATERIAL AT ATMOSPHERIC PRESSURE WHILE SAID AIRLOCK IS CLOSED AND EVACUATING SAID FIRST AND SECOND VACUUM CHAMBERS*	The steps of claim 21 do not actually recite an order and hence would not be correctly construed to require one.	The disposing step must occur before the evacuating step.	**The "disposing" step must occur prior to the "evacuating" step in the first vacuum chamber. However, the "evacuating" step in the second chamber may occur before or after said "disposing" step, provided that the airlock is closed as per the disposing step prior to evacuating the second vacuum chamber, and provided further that both the first and second vacuum chambers have been evacuated prior to the "transporting" and remaining steps in claim number 21 of the '784 patent.**

D. *ISOLATING SAID GASEOUS FILM-FORMING MATERIAL IN SAID FIRST VACUUM CHAMBER FROM GASES IN ANY OTHER CHAMBER OF SAID PLURALITY OF VACUUM CHAMBERS*	No construction is necessary. Alternatively, if the term phrase is construed: the gaseous film-forming material introduced into the first vacuum chamber is isolated from gases in any one of multiple vacuum chambers.	It includes the requirement that different process gases (i.e., film-forming material) be used in at least two separate processing chambers in which a glow discharge deposition is carried out.	**Preventing said gaseous film-forming material in said first vacuum chamber from being mixed with or contaminated by gases present in any other chamber of said plurality of vacuum chambers, or the atmosphere, by closing off said first vacuum chamber from any other chamber of said plurality of chambers or by controlling the pressure within said first vacuum chamber and said plurality of vacuum chambers to exclude said gases from said first vacuum chamber.**
E. *ADJUSTING PRESSURE IN SAID FIRST VACUUM CHAMBER TO POSITION SAID GLOW DISCHARGE ABOVE SAID SUBSTRATE*	The pressure in the vacuum chamber is set, i.e., selected and regulated, to maintain the glow discharge above the substrate.	Changing the pressure in said first vacuum chamber after the glow discharge has been struck to position the glow discharge above said substrate.	**Changing the pressure in said first vacuum chamber to control the location of the glow discharge such that it occurs above said substrate.**
F. *A BARRIER LAYER COMPRISING GLOW DISCHARGE DEPOSITED HYDROGENATED NITRIDE OF SILICON AND A METAL OXIDE*	A layer which includes both a "metal oxide" layer and a "glow discharge deposited hydrogenated nitride of silicon," and which acts as a barrier between the conductive electrode and the layer of hydrogenated amorphous silicon.	A layer that current passes through when the device is working that is a single layer containing both glow discharge deposited hydrogenated nitride of silicon and purposefully, non-incidentally deposited metal oxide.	**A coating of material that separates the hydrogenated amorphous silicon from the conductive layer or electrode of a semiconductor device, where said coating of material is comprised of a coating of glow discharge deposited nitride of silicon and an additional coating of a metal oxide.**

G. *A BARRIER LAYER COMPRISING GLOW DISCHARGE DEPOSITED HYDROGENATED NITRIDE OF SILICON AND A METAL OXIDE*	It includes both metal oxides as well as other metallic oxides. Alternatively: a compound formed by the combining of oxygen atoms and metallic atoms (as defined by the Periodic Table: IA, IIA, IB~VIIIB, IIIA: Al, Ga, In, TL; IVA: Si, Ge, Sn, Pb; VA: As, Sb, Bi; VIA: Se, Te, Po) by covalent bonds.	A binary compound of metal and oxygen that has been purposefully, non-incidentally deposited on the substrate.	**A compound of a metal and oxygen, where said metal can be a metal or metalloid.**

APPENDIX 'B'

DEFINITIONS FOR THE FOLLOWING WORDS OR PHRASES (from Funk & Wagnalls, New Comprehensive International Dictionary of the English Language, Encyclopedic Edition (1978)):

1. **GLOW DISCHARGE. (Id. at 539).**
2. **EVACUATE. (Id. at 439).**
3. **ISOLATE. (Id. at 676).**
4. **SEMICONDUCTOR. (Id. at 1143).**
5. **METAL. (Id. at 800).**
6. **METALLIC. (Id.)**
7. **METALLOID. (Id.)**

Funk & Wagnalls

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os·sa (glôs'ə, glos'ə), **Cape** A promontory in W Albania; ancient *Acroceraunia*: Italian *Capo Linguetta*.

os·sal (glôs'əl, glos'-) *adj.* Of or pertaining to the tongue; having a tongue; lingual.

os·sa·rist (glos'ə-rist, glôs'-) *n.* One who writes glosses; also, one who compiles a glossary. Also **glos·sa·tor** (glo·sā'tər, glô-).

os·sa·ry (glos'ə-rē, glôs'-) *n. pl.* **·ries** 1 A lexicon of the obsolete, obscure, or foreign words of a work. 2 Any explanatory vocabulary, as of a science. [<L *glossarium* < *glossa* GLOSS²] — **glos·sar·i·al** (glo·sâr'ē·əl, glô-) *adj.* — **glos·sar'i·al·ly** *adv.*

os·sec·to·my (glo·sek'tə·mē, glô-) *n. Surg.* Total or partial removal of the tongue or of a glossal lesion.

los·si·na (glo·sī'nə, glô-) *n.* An Ethiopian genus of biting flies which includes the tsetse fly, carrier of the infective agent of African sleeping sickness. For illustration see under INSECT (injurious). [<NL <Gk. *glōssa* tongue]

os·si·tis (glo·sī'tis, glô-) *n. Pathol.* Inflammation of the tongue. — **glos·sit·ic** (-sit'ik) *adj.*

osso- *combining form* The tongue; pertaining to the tongue: *glossography*. Also, before vowels, **gloss-**. [<Gk. *glōssa* tongue]

os·sog·ra·phy (glo·sog'rə·fē, glô-) *n.* 1 A description of the tongue. 2 The making of glosses or of glossaries. — **glos·sog'ra·pher** *n.*

os·sol·o·gy (glo·sol'ə·jē, glô-) *n. Obs.* The science of language; comparative philology: also called *glottology*.

oss·y (glôs'ē, glos'ē) *adj.* **gloss·i·er, gloss·i·est** Having a lustrous surface; polished. 2 Outwardly or speciously fair. See synonyms under SMOOTH. — **gloss'i·ly** *adv.* — **gloss'i·ness** *n.*

ost (glôst, glost) *n.* Lead glaze used in making pottery; also, glazed pottery. [Variant of GLOSS¹]

ot *combining form* Able to speak, or written in, a number of languages: *polyglot*. [<Gk. *glōtta*, var. of *glōssa* tongue, language]

ot·tal (glot'l) *adj.* Of, pertaining to, or articulated in the glottis.

ottal stop *Phonet.* A sound produced in the larynx by an instantaneous closure of the glottis, as at the beginning of a cough, or in one pronunciation of *bottle*: not a phoneme in English.

ot·tic (glot'ik) *adj.* 1 Of or pertaining to the tongue. 2 Of, pertaining to, or produced by the glottis; glottal. 3 *Obs.* Linguistic.

ot·tis (glot'is) *n. pl.* **·ti·des** (-ə·dēz) *Anat.* The cleft or opening between the vocal folds at the upper orifice of the larynx; the mouth of the windpipe. [<NL <Gk. *glōttis* < *glōtta* tongue]

ot·to·gon·ic (glot'ə·gon'ik) *adj.* Pertaining to the genesis of language. [<Gk. *glōtta*, var. of *glōssa* tongue, language + *-gon*, stem of *gignesthai* come to be]

ot·tol·o·gy (glo·tol'ə·jē) See GLOSSOLOGY.

louces·ter (glos'tər, glôs'-), **Duke of** See under HUMPHREY. — **Richard**, 1452–85, Duke of Gloucester, became king of England 1483, as Richard III.

louces·ter (glos'tər, glôs'-) 1 A county in west central England; 1,257 square miles; county town, Gloucester. Also **Gloucester·shire** (-shir). 2 A port and resort in NE Massachusetts.

love (gluv) *n.* A covering for the hand, having a separate sheath for each finger. — **the gloves** Boxing gloves. — *v.t.* **gloved, glov·ing** 1 To put gloves on. 2 To cover with or as with a glove. 3 To serve as a glove for. [OE *glōf*]

lov·er (gluv'ər) *n.* A maker of or a dealer in gloves.

lov·ers·ville (gluv'ərz·vil) A city in central New York; center of leather glove and mitten manufacture.

low (glō) *v.i.* 1 To give off light and heat, especially without flame; be incandescent. 2 To shine as if greatly heated. 3 To show a strong, bright color; be bright or red, as with heat or animation; blush. 4 To be animated with strong emotion. 5 To be excessively hot; burn. — *n.* 1 The incandescence of a heated substance. 2 Bright color; redness; flush; ruddiness. 3 Fervid heat; strong emotion or ardor. 4 Bodily warmth, as caused by exercise, etc. See synonyms under LIGHT¹, WARMTH. [OE *glōwan*]

low-dis-charge (glō'dis·chärj') *n.* The initial luminous electrical discharge in a gas, as observed in neon lamps, etc.

low·er (glou'ər) *v.i.* 1 To stare with an angry frown; scowl sullenly. 2 *Scot.* To stare. — *n.* The act of glowering; a fierce or threatening stare. Also *Scot.* **glour, glowr.** [? Freq. of obs. *glow* stare] — **glow'er·ing** *adj.* — **glow'er·ing·ly** *adv.*

low·fly (glō'flī') *n.* A firefly.

low·ing (glō'ing) *adj.* Having a glow; ardent; bright; also, enthusiastic. — **glow'ing·ly** *adv.*

low lamp An incandescent lamp, usually electrical.

low potential The voltage marking the beginning of a glow-discharge.

low·worm (glō'wûrm') *n.* 1 A European beetle (genus *Lampyris*), the larva and wingless female of which display phosphorescent light. 2 The luminous larva of American fireflies.

lox·in·i·a (glok·sin'ē·ə) *n.* Any plant of a genus *(Sinningia)*, with opposite leaves and large bell-shaped spotted flowers. [after B. P. *Gloxin*, 18th century German physician]

loze¹ (glōz) *v.* **glozed, gloz·ing** *v.t.* 1 To explain away; palliate: usually with *over*. 2 *Obs.* To flatter. 3 *Obs.* To explain by notes or glosses. — *v.i.* 4 *Obs.* To make notes or glosses. — *n. Obs.* 1 Specious show; gloss. 2 A note, gloss, or comment. 3 Flattery. [<OF *gloser* explain < *glose* a note <L *glossa*. See GLOSS².]

loze² (glōz) *v.t.* & *v.i.* **glozed, gloz·ing** *Rare* To shine; light up; gleam. [Cf. GLOSS¹]

loz·ing (glō'zing) *n.* 1 Specious flattery. 2 Annotation.

lu·ci·num (glōō·sī'nəm) *n.* Beryllium. Also **glu·ci'l·um** (-sin'ē·əm). [<NL <Gk. *glykys* sweet; because some of its salts are sweet to taste]

Gluck (glōōk), **Alma**, 1884–1938, U. S. soprano, born in Rumania. — **Christoph Willibald**, 1714–87, German composer.

glu·co·pro·te·in (glōō'kō·prō'tē·in, -tēn) See GLYCOPROTEIN.

glu·cose (glōō'kōs) *n. Chem.* 1 Dextrose or grape sugar; a monosaccharide carbohydrate having the formula $C_6H_{12}O_6$. It is widely distributed in plants and animals and is obtained by the hydrolysis of starch and other carbohydrates. It is fermentable but less sweet than cane sugar. 2 A thick yellowish sirup containing dextrose, maltose, and dextrin, obtained by incomplete hydrolysis of starch and used in confectionery, baking, etc. [<Gk. *glykys* sweet + -OSE³] — **glu·cos'ic** (-kos'ik) *adj.*

glu·co·side (glōō'kə·sīd) See GLYCOSIDE.

glu·co·su·ri·a (glōō'kō·sōōr'ē·ə) See GLYCOSURIA.

glue (glōō) *n.* 1 A viscid cement or adhesive preparation, usually a form of impure gelatin derived from boiling certain animal substances, as skin, bones, and cartilage, in water. It is a typical colloid. 2 Any of a number of sticky substances. — *v.t.* **glued, glu·ing** To stick or fasten with or as with glue. [<OF *glu* birdlime <LL *glus, glutis*] — **glue'y** *adj.*

glum (glum) *adj.* **glum·mer, glum·mest** Moody and silent; sullen. [Akin to GLOOM] — **glum'ly** *adv.* — **glum'ness** *n.*

glu·ma·ceous (glōō·mā'shəs) *adj.* Bearing, or pertaining to, glumes.

glume (glōōm) *n. Bot.* A chafflike scale on the lowest bracts of a grass spikelet. ◆ Homophone: *gloom*. [<L *gluma* husk]

glump·y (glum'pē) *adj.* Sullen; sulky; grumpy. [? Blend of GLUM and GRUMPY]

glunch (glōōnsh, glunsh) *Scot. v.i.* To frown; look sullen. — *adj.* Sullen and sour. — *n.* A look expressive of displeasure.

glut¹ (glut) *v.* **glut·ted, glut·ting** *v.t.* 1 To fill or supply to excess; satiate; gorge. 2 To supply (the market) with an excessive quantity of an article and bring on a lowering of prices. — *v.i.* 3 To eat gluttonously; gormandize. See synonyms under PAMPER, SATISFY. — *n.* 1 An excessive supply; plethora. 2 A full supply. 3 The condition of being glutted; act of glutting. [< obs. *glut* a glutton <OF *gloutir* swallow <L *glutire*]

glut² (glut) *n.* A wooden wedge used in splitting logs. [Cf. dial. *clut* a cleat]

glu·tam·ic acid (glōō·tam'ik) *Chem.* An amino acid, $C_5H_9O_4N$; a white crystalline compound obtained by acid hydrolysis of animal and vegetable proteins, as wheat kernels, gluten, etc.

glu·ta·mine (glōō'tə·mēn, -min) *n. Biochem.* A protein, $C_5H_{10}O_3N_2$, found in the roots, seedlings, and leaves of certain plants, especially of the mustard family. [<GLUT(EN) + -AMINE]

glu·ta·thi·one (glōō'tə·thī'ōn) *n. Biochem.* A peptide of glutamic acid, cystine, and glycine, $C_{10}H_{17}O_6N_3S$, obtained from yeast; found also in muscle tissue, blood, and plants. [< GLUTA(MIC) + THI- + -ONE]

glu·te·al (glōō·tē'əl, glōō'tē·əl) *adj. Anat.* Of or pertaining to the muscles of the buttocks. [<GLUTEUS]

glu·te·lin (glōō'tə·lin) *n. Biochem.* Any of a class of simple proteins found in certain plants, as wheat. [<GLUTEN + *-lin*, an arbitrary ending]

glu·ten (glōōt'n) *n.* A mixture of plant proteins found in cereal grains; a tough, sticky substance obtained by washing out the starch from wheat flour: used as an adhesive and thickener. [<L, glue] — **glu'te·nous** *adj.*

gluten bread Bread made from flour rich in gluten and containing little starch.

glu·te·us (glōō·tē'əs) *n. pl.* **·te·i** (-tē'ī) *Anat.* Any of three muscles in the region of the buttocks. [<NL <Gk. *gloutos* rump]

glu·ti·nous (glōō'tə·nəs) *adj.* 1 Resembling glue; sticky. 2 Pervaded with sticky matter. See synonyms under ADHESIVE. — **glu'ti·nous·ly** *adv.* — **glu'ti·nous·ness** *n.*

glut·ton¹ (glut'n) *n.* 1 One who gluts himself; an excessive eater. 2 One who has an excessive appetite for anything. [<OF *glouton* <L *gluto, -onis* a glutton]

glut·ton² (glut'n) *n.* A musteline carnivore, the wolverine *(Gulo luscus)*, especially the Old World form. [Trans. of G *vielfrass* great eater]

glut·ton·ize (glut'ən·īz) *v.t.* & *v.i.* **·ized, ·iz·ing** To eat (food) gluttonously.

glut·ton·ous (glut'ən·əs) *adj.* Voracious. — **glut'ton·ous·ly** *adv.*

glut·ton·y (glut'ən·ē) *n. pl.* **·ton·ies** The act or habit of eating to excess.

gly·cer·ic (gli·ser'ik, glis'ər-) *adj.* Of or derived from glycerol.

glycerie acid *Chem.* A colorless, sirupy compound, $C_3H_6O_4$, formed during alcoholic fermentation and by oxidizing glycerol with nitric acid.

glyc·er·ide (glis'ər·īd, -id) *n. Chem.* An ether or ester of glycerol with a fatty acid.

glyc·er·in (glis'ər·in) See GLYCEROL. Also **glyc'er·ine** (-in, -ēn).

glyc·er·ol (glis'ər·ōl, -ol) *n. Chem.* A sweet, oily, nearly colorless trihydric alcohol, $C_3H_8O_3$, formed by decomposition of natural fats with alkalis or superheated steam; also obtained from petroleum products. Also called *glycerin*. [<Gk. *glykeros* sweet + -OL²]

glyc·er·yl (glis'ər·il) *n. Chem.* The trivalent glycerol radical C_3H_5. [<GLYCER(IN) + -YL]

gly·cine (gli'sēn, gli·sēn') *n. Chem.* A sweet, colorless amino acid, $C_2H_5O_2N$, obtained from various proteins. Also **gly·co·coll** (gli'kō·kol, -kol). [<Gk. *glykys* sweet + -INE²]

gly·co·gen (gli'kə·jən) *n. Biochem.* A white, mealy, amorphous polysaccharide, $(C_6H_{10}O_5)_x$, contained in animal tissues, principally the liver: also called *animal starch*. [<Gk. *glykys* sweet + -GEN]

gly·co·gen·ase (gli'kə·jə·nās') *n. Biochem.* An enzyme present in the liver which converts glycogen to a saccharide. [<GLYCOGEN + -ASE]

gly·co·gen·ic (gli'kə·jen'ik) *adj.* 1 Relating to the formation of glycogen. 2 Caused by glycogen.

gly·col (gli'kōl, -kol) *n. Chem.* 1 A colorless, sweetish compound, $C_2H_6O_2$, formed by decomposing certain ethylene compounds: used as a solvent, as a freezing mixture, and in the manufacture of explosives, intermediates, etc. 2 Any dihydroxyl alcohol of the glycol group having the general formula $C_nH_{2n}(OH)_2$. [<GLYC(ERIN) + -OL¹]

gly·col·ic acid (gli·kol'ik) *Chem.* An acid, $C_2H_4O_3$, found in the juice of cane sugar and unripe grapes; also made synthetically.

See illustration under EAR. [after Bartolommeo *Eustachio*]

E·u·sta·chio (ā′o͞o·stä′kyō), **Bartolommeo,** 1520–74, Italian anatomist.

eu·tax·it·ic (yo͞o′tak·sit′ik) Of or pertaining to ore deposits occurring in stratified form: opposed to *ataxitic.*

eu·tax·y (yo͞o′tak′sē) *n.* Good arrangement; orderly disposition. [<Gk. *eutaxia* <*eu-* good + *taxis* arrangement <*tassein* arrange]

eu·tec·tic (yo͞o·tek′tik) *adj. Chem.* Melting readily or at a low temperature: said of an alloy or a solution that has the lowest possible fusing point, usually below that of any of the components taken separately. — *n.* A eutectic substance, as an alloy. [<Gk. *eutēktos* <*eu-* well, easily + *tēkein* fuse]

eu·tec·toid (yo͞o·tek′toid) *adj. Chem.* Like a eutectic; formed at the lowest temperature.

eu·tel·e·gen·e·sis (yo͞o·tel′ə·jen′ə·sis) *n. Biol.* Artificial insemination. [<EU- + TELE- + GENESIS] — **eu·tel′e·gen′ic, eu·tel′e·ge·net′ic** *adj.*

Eu·ter·pe (yo͞o·tûr′pē) The Muse of lyric song and music. — **Eu·ter′pe·an** *adj.*

eu·tha·na·si·a (yo͞o′thə·nā′zhē·ə, -zhə) *n.* 1 Painless, peaceful death. 2 The deliberate putting to death of a person suffering from a painful and incurable disease; mercy killing. [<Gk. <*eu-* easy + *thanatos* death]

eu·then·ics (yo͞o·then′iks) *n. pl. (construed as singular)* 1 The science of improving the human race by external influences, apart from considerations of heredity. 2 The science which aims at securing the most favorable environmental conditions for the growth of plants and animals. Compare EUGENICS. [< Gk. *euthenia* well-being] — **eu′the·nist** *n.*

Eu·the·ri·a (yo͞o·thir′ē·ə) *n.* A subclass of mammals characterized by a highly developed placenta and lengthy prenatal development of offspring: includes man and most of the mammalian types: formerly called *Monodelphia.* [<NL <Gk. *eu-* good, typical + *thērion* animal]

eu·troph·ic (yo͞o·trof′ik, -trō′fik) *adj. Ecol.* Of a lake or other body of water, characterized by an advanced stage of eutrophication; rich in nutrients; mature. [<Gk. *eutrophos* well-nourished]

eu·troph·i·ca·tion (yo͞o·trof′ə·kā′shən, -trō′fə-) *n. Ecol.* The process by which a body of water, as a lake, matures and ages, characterized by an environment growing progressively richer in mineral and organic nutrients, resulting in a seasonally recurring depletion in oxygen that is ultimately incompatible with animal life. [< EUTROPHIC + -ATION]

eux·e·nite (yo͞ok′sə·nīt) *n.* A brilliant, metallic-vitreous, brownish-black mineral crystallizing in the orthorhombic system and valuable as a source of certain rare elements, as titanium, germanium, cerium. [<Gk. *euxenos* hospitable + -ITE¹, because it often contains rare elements]

Eux·ine Sea (yo͞ok′sin, -sīn) See BLACK SEA.

E·va (ē′və; *Du., Ger., Ital., Pg., Sp.* ā′vä; *Sw.* e′vä) A feminine personal name. Also **Eve** (ēv), *Fr.* **Ève** (ev). [See EVE]

e·vac·u·ant (i·vak′yo͞o·ənt) *adj. Med.* Producing evacuation; cathartic, diuretic, or emetic. — *n.* Something that assists evacuation.

e·vac·u·ate (i·vak′yo͞o·āt) *v.* **·at·ed, ·at·ing** *v.t.* 1 *Mil.* **a** To give up or abandon possession of; withdraw from, as a fortress or city. **b** To withdraw (troops, inhabitants, etc.) from a threatened area or place. 2 To make empty; vacate. 3 To remove the contents of. 4 *Physiol.* To discharge or eject, as from the bowels. — *v.i.* 5 To withdraw, as from a threatened area or place. [<L *evacuatus,* pp. of *evacuare* <*e-* out + *vacuare* make empty <*vacuus* empty] — **e·vac′u·a′tive, e·vac′u·a·to′ry** (-tôr′ē, -tō′rē) *adj.* — **e·vac′u·a′tor** *n.*

e·vac·u·a·tion (i·vak′yo͞o·ā′shən) *n.* 1 The act of evacuating or making empty: the *evacuation* of a fort. 2 *Physiol.* That which is evacuated or ejected by excretory passages, especially by the bowels. 3 The act of making void or null, as a contract.

e·vac·u·ee (i·vak′yo͞o·ē′) *n.* One who has been removed from or has abandoned his home.

e·vade (i·vād′) *v.* **e·vad·ed, e·vad·ing** *v.t.* 1 To escape or get away from by tricks or cleverness; save oneself from: to *evade* pursuers or a crisis. 2 To avoid or get out of; get around: to *evade* a question or a duty. 3 To baffle; elude: The facts *evade* explanation. — *v.i.* 4 To practice evasion. 5 *Rare* To escape; get away. See synonyms under ESCAPE. [<L *evadere* <*e-* out + *vadere* go] — **e·vad′a·ble, e·vad′i·ble** *adj.* — **e·vad′er** *n.*

e·vag·i·nate (i·vaj′ə·nāt) *v.t.* **·nat·ed, ·nat·ing** *Biol.* To turn inside out, as a tubular organ; protrude by eversion; unsheathe. [<LL *evaginatus,* pp. of *evaginare* <*e-* out + *vagina* a sheath] — **e·vag′i·na′tion** *n.*

e·val·u·ate (i·val′yo͞o·āt) *v.t.* **·at·ed, ·at·ing** 1 To find or determine the amount, worth, etc., of; appraise. 2 *Math.* To determine the numerical value of. [<F *évaluer* <*e-* out (<L *ex*) + *valuer* <OF *valoir.* See VALUE.]

e·val·u·a·tion (i·val′yo͞o·ā′shən) *n.* Accurate appraisal of value.

Ev·an (ev′ən) A masculine personal name. [<Celtic, young warrior]

ev·a·nesce (ev′ə·nes′) *v.i.* **·nesced, ·nesc·ing** To disappear by degrees; vanish gradually. [<L *evanescere* <*e-* out + *vanescere* vanish <*vanus* empty] — **ev′a·nes′ci·ble** *adj.*

ev·a·nes·cent (ev′ə·nes′ənt) *adj.* Passing away, or liable to pass away, gradually or imperceptibly. See synonyms under TRANSIENT. [<F *évanescent* <L *evanescens, -entis,* ppr. of *evanescere.* See EVANESCE.] — **ev′a·nes′cence** *n.* — **ev′a·nes′cent·ly** *adv.*

e·van·gel¹ (i·van′jəl) *n.* 1 The message of redemption through Jesus Christ; the Christian gospel. 2 *Usually cap.* One of the four Gospels of the New Testament. 3 Any good news or glad tidings. [<OF *evangile* <LL *evangelium* <Gk. *euangelion* good news <*eu-* good + *angellein* announce]

e·van·gel² (i·van′jəl) An evangelist. [<MGk. *euangelos* <*eu-* good + *angelos* messenger]

e·van·gel·i·cal (ē′van·jel′i·kəl, ev′ən-) *adj.* 1 In or agreeing with the four Gospels or the teachings of the New Testament. 2 Denoting the adherents of a school of Protestant theology stressing the divine inspiration, authority, and sufficiency of the Scriptures, the fallen state of man, salvation by faith in the redeeming work of Christ, and spiritual regeneration, and denying in whole or in part the efficacy of the sacraments and the authority of the church. 3 *U.S.* Loosely, orthodox; Trinitarian in belief. 4 Zealous or fervent: *evangelical* preaching. 5 Pertaining to the work of an evangelist; evangelistic: *evangelical* labors. — *n.* A member of an evangelical church, or of an evangelical party within a church, as of the Low Church party in Anglicanism. Also **e′van·gel′ic.** [<LL *evangelicus* <Gk. *euangelikos* <*euangelion.* See EVANGEL¹.] — **e′van·gel′i·cal·ism, e′van·gel′i·cism** *n.* — **e′van·gel′i·cal·ly** *adv.* — **e′van·gel′i·cal·ness, e·van·ge·lic·i·ty** (i·van′jə·lis′ə·tē) *n.*

Evangelical and Reformed Church A presbyterial Protestant denomination, first organized in 1934, and, since 1957, a part of the *United Church of Christ.*

Evangelical Counsel See COUNSEL OF PERFECTION.

E·van·ge·line (i·van′jə·lin, -līn, -lēn) A feminine personal name. [<Gk., bearer of glad tidings] — **Evangeline** The heroine of Longfellow's poem of this name.

e·van·gel·ism (i·van′jə·liz′əm) *n.* 1 The zealous preaching or spreading of the gospel. 2 The work of an evangelist.

e·van·gel·ist (i·van′jə·list) *n.* 1 *Usually cap.* One of the four writers of the New Testament Gospels; Matthew, Mark, Luke, or John. 2 An itinerant or missionary preacher; a revivalist. 3 In the Mormon Church, a patriarch.

e·van·gel·is·tic (i·van′jə·lis′tik) *adj.* 1 Pertaining to an evangelist. 2 Evangelical. 3 Seeking or suited to evangelize. — **e·van′gel·is′ti·cal·ly** *adv.*

e·van·gel·ize (i·van′jəl·īz) *v.* **·ized, ·iz·ing** *v.t.* 1 To preach the gospel to. 2 To convert to Christianity. — *v.i.* 3 To preach as an evangelist. — **e·van′gel·i·za′tion** *n.* — **e·van′gel·iz′er** *n.*

e·van·ish (i·van′ish) *v.t. Poetic* To vanish; disappear; die away.

Ev·ans (ev′ənz), **Sir Arthur John,** 1851–1941, English archeologist. — **Herbert McLean,** born 1882, U.S. anatomist and embryologist. — **Maurice,** born 1901, English actor. — **Robley Dunglison,** 1846–1912, U.S. admiral. — **Rudulph,** 1878–1960, U.S. sculptor.

Ev·ans·ton (ev′ən·stən, -ənz·tən) A city on Lake Michigan, Illinois; a northern suburb of Chicago.

Ev·ans·ville (ev′ənz·vil′) A city on the Ohio River in SW Indiana.

e·vap·o·ra·ble (i·vap′ər·ə·bəl) *adj.* Capable of being converted into vapor. — **e·vap′o·ra·bil′i·ty** *n.*

e·vap·o·rate (i·vap′ə·rāt) *v.* **·rat·ed, ·rat·ing** *v.t.* 1 To convert into vapor, usually by application of heat; vaporize. 2 To remove moisture from by a drying or heating process; to concentrate (fruit, milk, etc.) by evaporation. — *v.i.* 3 To become vapor; pass off as vapor. 4 To yield vapor. 5 To vanish; disappear. [<LL *evaporatus,* pp. of *evaporare* <*e-* out, away + *vapor.* See VAPOR.] — **e·vap′o·ra′tive** *adj.*

evaporated milk Cow's milk, unsweetened, with much of its water content removed.

e·vap·o·ra·tion (i·vap′ə·rā′shən) *n.* 1 The act or process of changing or being changed into vapor, specifically, at temperatures below the boiling point. 2 A rising of or passing off in vapor. 3 The act of drying or concentrating. 4 The result of evaporation; vapor.

e·vap·o·ra·tor (i·vap′ə·rā′tər) *n.* An apparatus for drying substances, as fruits, by evaporation.

e·vap·o·rim·e·ter (i·vap′ə·rim′ə·tər) *n.* An apparatus for testing the rate of evaporation of a liquid; an atmometer. Also **e·vap′o·rom′e·ter.**

Ev·arts (ev′ərts), **William Maxwell,** 1818–1901, U.S. lawyer and statesman.

e·va·sion (i·vā′zhən) *n.* The act, means, or result of evading; equivocation; subterfuge. [<LL *evasio, -onis* <*evadere.* See EVADE.]

e·va·sive (i·vā′siv) *adj.* Tending or seeking to evade; marked by evasion; elusive. — **e·va′sive·ly** *adv.* — **e·va′sive·ness** *n.*

Ev·att (ev′ət), **Herbert Vere,** born 1894, Australian lawyer and statesman.

eve (ēv) *n.* 1 *Poetic* Evening. 2 The evening before a church festival or saint's day: Christmas *Eve.* 3 The time immediately preceding some event. [Var. of EVEN²]

Eve (ēv) A feminine personal name. [< Hebrew, life] — **Eve** The wife of Adam and the mother of all mankind. *Gen.* iii 20.

e·vec·tics (i·vek′tiks) *n. pl. (construed as singular)* 1 The art of developing health, physical vigor, strength, and energy. 2 Hygiene. [<Gk. *euektikē (technē)* (skill) of good health <*eu echein* be well]

e·vec·tion (i·vek′shən) *n. Astron.* The largest inequality in the motion of the moon, due to the action of the sun, which causes periodic changes in the eccentricity of the moon's orbit. [<LL *evectio, -onis* <*evehere* <*e-* out + *vehere* carry] — **e·vec′tion·al** *adj.*

Ev·e·li·na (ev′ə·lī′nə, -lē′-) A feminine personal name. Also **Ev′e·line** (-lin, -lēn, -lin). [<Celtic, pleasant]

Ev·e·lyn (ev′ə·lin, ēv′lin) A feminine, or (especially British) masculine, personal name. [<L, hazelnut]

Eve·lyn (ēv′lin), **John,** 1620–1706, English diarist; one of the founders of the Royal Society.

e·ven¹ (ē′vən) *adj.* 1 Free from inequalities or irregularities; level; uniform. 2 Divisible by 2 without remainder: said of numbers. 3 On the same level or line. 4 Without advantage on either side; of the same character; equal; fair; impartial. 5 Unvarying in disposition, action, or quality. 6 Whole or entire: said of money, numbers, etc.: *even* dollars. See synonyms under FLAT, HORIZONTAL, JUST, LEVEL, SMOOTH. — **of even date** *Law* Of identical date. — **on an even keel** Smoothly: from a nautical phrase applied to a ship with the same draft of water forward and aft. — **to get even** To get revenge; retaliate. — *adv.* 1 To a like degree; at the very time; so far or so much as; exactly; precisely; fully; quite: used to express emphasis, surprise, concession, or extension to what might not be expected: *even* to the end, intelligible *even* to a child. 2 As much as; yet: They would not believe the report, nor *even* the evidence. 3 Smoothly; regularly;

which volume is the constant quantity. Also **i'so·chor.** [<ISO- + Gk. *chōra* space] — **i'so·chor'ic** *adj.*

i·so·chro·mat·ic (ī'sō·krō·mat'ik) *adj.* 1 *Optics* Having or denoting identity of color. 2 Orthochromatic.

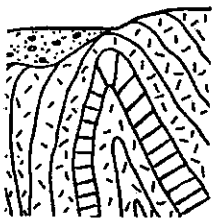
i·so·chron (ī'sə·kron) *n. Biol.* In studies of growth, a mathematical function equal to one percent of the time required to attain maturity. Also **i'so·chrone** (-krōn). [<ISO- + Gk. *chronos* time]

i·soch·ro·nal (ī·sok'rə·nəl) *adj.* Relating to or characterized by equal intervals of time, as a pendulum that always vibrates in the same period. Also **i·so·chron·ic** (ī'sə·kron'ik), **i·soch'ro·nous.** — **i·soch'ro·nous·ly** *adv.*

i·soch·ro·nize (ī·sok'rə·nīz) *v.t.* **·nized, ·niz·ing** To make isochronal. — **i·soch'ro·nism** *n.*

i·soch·ro·ous (ī·sok'rō·əs) *adj.* Having the same color or tint throughout. [<ISO- + -CHROOUS]

i·so·cli·nal (ī'sə·klī'nəl) *adj.* 1 Dipping at the same angle and in the same direction. 2 Designating a line projected on the earth's surface connecting places that have the same inclination to the earth's magnetic field. 3 *Geol.* Pertaining to an isocline. — *n.* An isoclinal line.



ISOCLINE
Vertical isoclinal folds.

i·so·cline (ī'sə·klīn) *n. Geol.* A rock fold in which the strata are so closely appressed that the sides are parallel. [<ISO- + Gk. *klinein* bend] — **i'so·clin'ic** (-klin'ik) *adj.*

i·so·cosm (ī'sə·koz'əm) *n. Physics* A line connecting points on the earth's surface showing an equal cosmic ray intensity. [<ISO- + Gk. *kosmos* world]

i·soc·ra·cy (ī·sok'rə·sē) *n. pl.* **·cies** Equality in government; government in which all have equal power. [<Gk. *isokratia* < *iso-* same + *-kratia* rule < *kratos* power] — **i·so·crat** (ī'sə·krat) *n.* — **i'so·crat'ic** *adj.*

I·soc·ra·tes (ī·sok'rə·tēz), 436–338 B.C., Athenian orator.

i·so·cy·a·nine (ī'sō·sī'ə·nēn, -nin) *n. Chem.* Any of a group of quinoline dyes used in sensitizing photographic plates. Also **i'so·cy'a·nin** (-nin).

i·so·cy·clic (ī'sō·sī'klik, -sik'lik) *adj.* 1 *Chem.* Pertaining to or designating any of two or more closed-chain hydrocarbon compounds containing the same number of atoms. 2 *Bot.* Denoting a flower whose whorls have an equal number of parts.

i·so·def (ī'sə·def) *n.* An isogram joining points that show an equal percentage deviation from the mean of some specified phenomenon or characteristic. [<ISO- + DEF(ICIENCY)]

i·so·des·mic (ī'sō·dez'mik) *adj. Physics* Pertaining to or denoting an ionic crystal structure in which all the bonds are of equal strength. [<ISO- + Gk. *desmos* chain]

i·so·di·a·met·ric (ī'sō·dī'ə·met'rik) *adj.* 1 Equal in the three dimensions. 2 Having only the lateral axes equal, as crystals of the tetragonal and hexagonal systems.

i·so·di·mor·phism (ī'sō·dī·môr'fiz·əm) *n.* The phenomenon in which two or more similar crystals are at the same time isomorphous and dimorphous. — **i'so·di·mor'phous** *adj.*

i·so·dose (ī'sə·dōs) *n.* The same or an equal dose, as of drugs, X-rays or other forms of radioactivity.

i·so·dy·nam·ic (ī'sō·dī·nam'ik) *adj.* 1 Relating to or characterized by equality of force. 2 Designating any line on the earth's surface at all points of which the intensity of terrestrial magnetism is the same. Also **i'so·dy·nam'i·cal.**

i·so·e·lec·tric (ī'sō·i·lek'trik) *adj.* 1 Exhibiting the same electric potential. 2 *Chem.* Designating the *p*H value at which a colloidal suspension is electrically neutral with respect to the surrounding medium. [<ISO- + ELECTRIC]

i·so·e·lec·tron·ic (ī'sō·i·lek·tron'ik) *adj. Physics* Pertaining to or denoting atoms having the same number of valence electrons and similar physical properties.

i·so·eu·ge·nol (ī'sō·yōō'jə·nōl, -nol) *n. Chem.* A colorless oily liquid, $C_{10}H_{12}O_2$, derived from ylang-ylang and used in the manufacture of vanillin. [<ISO- + EUGENOL]

i·so·gam·ete (ī'sō·gam'ēt, -gə·mēt') *n. Biol.* One of a pair of uniting gametes similar in size, form, and structure: opposed to *heterogamete.*

i·sog·a·my (ī·sog'ə·mē) *n. Biol.* That form of sexual reproduction in which there is a union of two similarly formed sexual cells, or gametes. Compare OOGAMY. [<ISO- + -GAMY] — **i·sog'a·mous** *adj.*

i·so·ge·nous (ī·soj'ə·nəs) *adj.* 1 Having a similarity of origin. 2 *Biol.* Developed from the same cells or tissues. [<ISO- + -GENOUS] — **i·so·gen·e·sis** (ī'sō·jen'ə·sis), **i·sog'e·ny** *n.*

i·so·ge·o·therm (ī'sō·jē'ə·thərm) *n. Geol.* A line or surface along which the earth, below its surface, has the same temperature. [< ISO- + GEO- + Gk. *thermē* heat] — **i'so·ge'o·ther'mal, i'so·ge'o·ther'mic** *adj.*

i·so·gloss (ī'sə·glôs, -glos) *n. Ling.* A line on a map in a dialect atlas delimiting areas within which certain linguistic features, as pronunciation, vocabulary, etc., are exhibited in common.

i·so·gon (ī'sə·gon) *n.* A polygon whose angles are all equal. [<ISOGONIC]

i·so·gon·ic (ī'sə·gon'ik) *adj.* 1 Having equal angles. 2 Denoting an isogonic line. Also **i·sog·o·nal** (ī·sog'ə·nəl). — *n.* An isogonic line. [<Gk. *isogōnios*]

isogonic line A line connecting points on the earth's surface having equal magnetic declination.

i·so·gram (ī'sə·gram) *n.* A line connecting points on a chart, map, or diagram which have equal values in relation to specified geographic features, physical conditions, or meteorological phenomena.

i·so·griv (ī'sə·griv) *n. Nav.* A line connecting points of equal grid variation. [<ISO- + GRIV(ATION)]

i·so·hel (ī'sə·hel) *n. Meteorol.* An isogram showing places of equal sunshine. [<ISO- + Gk. *hēlios* sun]

i·so·hy·dric (ī'sə·hī'drik) *adj. Chem.* Pertaining to or designating a chemical neutralization in which the *p*H value remains constant.

i·so·hy·et (ī'sə·hī'ət) *n. Meteorol.* A curve joining places of equal rainfall. [<ISO- + Gk. *hyetos* rain]

i·so·late (ī'sə·lāt, is'ə-) *v.t.* **·lat·ed, ·lat·ing** 1 To place in a detached or separate situation; set apart. 2 *Electr.* To insulate. 3 *Chem.* To obtain in a free or uncombined state, as an element or compound. 4 *Med.* To set apart from others, as a person with a communicable disease. 5 *Bacteriol.* To obtain a pure bacterial culture of (a specified disease or bacterium). — *n.* 1 A definite constituent or factor of some natural phenomenon, or aspect of experience, set apart from the whole for purposes of study, experiment, and analysis. 2 *Chem.* A pure compound, as one derived from an essential oil. [Back formation of ISOLATED <Ital. *isolato,* pp. of *isolare* isolate < *isola* island <L *insula* island] — **i'so·la'tor** *n.*

i·so·lat·ing (ī'sə·lā'ting, is'ə-) *adj. Ling.* Describing a language, such as Chinese, in which there is no distinction in form between the parts of speech, with meaning being determined primarily by word order.

i·so·la·tion·ism (ī'sə·lā'shən·iz'əm) *n.* The advocacy of national self-sufficiency and freedom from foreign political and economic alliances. — **i'so·la'tion·ist** *n.*

I·solde (i·sōld', *Ger.* i·zôl'də) See ISEULT. Also **I·solt'.**

i·so·lead (ī'sə·lēd) *n. Mil.* A curved line drawn on a chart which indicates instantly the required lead of a gun in relation to a moving target. Also **isolead curve.**

i·so·lec·i·thal (ī'sō·les'ə·thəl) *adj. Biol.* Having the yolk evenly distributed through the protoplasm of an egg. [<ISO- + Gk. *lekithos* yolk of an egg]

I·so·le E·o·lie (ē'zō·lā ē·ō'lyā) An Italian name for the LIPARI ISLANDS.

i·so·leu·cine (ī'sə·lōō'sēn) *n. Biochem.* An amino acid, $C_6H_{13}NO_2$, found in body tissues and believed to be essential in nutrition.

i·so·log (ī'sə·lôg, -log) *n. Chem.* An isologous compound. Also **i'so·logue.** [<ISOLOGOUS]

i·sol·o·gous (ī·sol'ə·gəs) *adj. Chem.* Having similar molecular structure but different atoms of the same valency: applied especially to those groups of hydrocarbon compounds that have a constant difference of two hydrogen atoms in their composition. [<ISO- + Gk. *logos* proportion]

i·so·lux (ī'sə·luks) *n. Optics* 1 A line plotted on an appropriate set of coordinates to connect points of equal illumination. 2 A diagram containing sets of such lines. [<ISO- + L *lux* light]

i·so·mag·net·ic (ī'sō·mag·net'ik) *adj.* Relating to or designating lines connecting points of equal magnetic force. — *n.* An isomagnetic line.

i·so·mer (ī'sə·mər) *n. Chem.* A compound having the same molecular weight and formula as another but with a different spatial arrangement of its atoms, resulting in different properties. [<Gk. *isomēres* equally divided < *isos* equal + *meros* part] — **i'so·mer'ic** (-mer'ik) *adj.*

i·som·er·ism (ī·som'ər·iz'əm) *n. Chem.* The condition of having different chemical or physical properties, or both, but identical molecular composition.

i·som·er·ous (ī·som'ər·əs) *adj.* 1 *Bot.* Equal in number, as the members of the successive circles or whorls of a flower: opposed to *heteromerous.* 2 *Entomol.* Having an equal number of tarsal joints on all feet: said of certain coleopterous insects. 3 Isomeric.

i·so·met·ric (ī'sō·met'rik) *adj.* 1 Having equality in dimensions or measurements. 2 Pertaining to that system of crystallization in which the three axes are equal in length and at right angles to each other. 3 *Physics* Indicating or maintaining the same proportions, measure, dimensions, etc., as a constant volume in a gas. Also **i'so·met'ri·cal.** 4 Based upon the forceful contraction of muscles against immovable resistance without shortening muscle fibers, a means of strengthening muscles: *isometric* exercises. — *n.* An isometric line. [<Gk. *isometros* < *isos* equal + *metron* measure] — **i'so·met'ri·cal·ly** *adv.*

i·so·me·tro·pi·a (ī'sō·mə·trō'pē·ə) *n. Optics* Equality of the focal length of the two eyes. [<ISO- + Gk. *metron* measure + -OPIA]

i·som·e·try (ī·som'ə·trē) *n.* 1 Equality in measured parts or proportions. 2 *Geog.* Equality of elevation, as of mountain peaks. [<Gk. *isometria* equality of measure < *isos* same + *metros* measure]

i·so·morph (ī'sə·môrf) *n.* An organism or crystal superficially like another but morphologically different. [<ISO- + Gk. *morphē* form] — **i'so·mor'phic** *adj.*

i·so·mor·phism (ī'sə·môr'fiz·əm) *n.* 1 The property shown by two substances of analogous chemical composition that crystallize in identical or nearly identical forms. 2 *Biol.* The possession of like characters by organisms of different groups, resulting usually from like environmental influences. — **i'so·mor'phous** *adj.*

i·so·neph (ī'sə·nef) *n. Meteorol.* An isogram showing places of equal degrees of cloudiness. [<ISO- + Gk. *nephos* cloud]

i·son·o·my (ī·son'ə·mē) *n.* 1 Equality of civil rights. 2 Equality in rank, kind, or grade in classification. [<Gk. *isonomia* < *isos* same + *nomos* law] — **i·so·nom·ic** (ī'sō·nom'ik) *adj.*

I·son·zo (ē·zôn'tsō) A river in NW Yugoslavia and NE Italy, flowing 84 miles south to the Gulf of Trieste.

i·so·oc·tane (ī'sō·ok'tān) *n. Chem.* Trimethylpentane.

i·sop·a·thy (ī·sop'ə·thē) *n. Med.* 1 The theory that a contagious disease contains in its own causative agent the means for its cure. 2 Treatment by the application or use of diseased matter. — **i·so·path·ic** (ī'sə·path'ik) *adj.*

i·so·phene (ī'sə·fēn) *n.* 1 *Ecol.* A contour line on a map indicating areas of equal frequency of a given plant or animal. 2 A line joining all places within a given area or region of the earth along which seasonal phenomena take place at the same time. [< ISO- + Gk. *phainein* reveal]

i·so·phot·ic (ī'sō·fot'ik) *adj. Bot.* Equally illuminated: said of leaves and other organs.

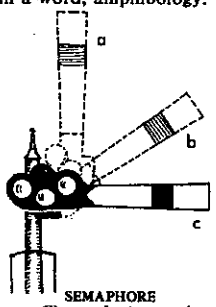
i·so·phyl·ly (ī'sō·fil'ē) *n. Bot.* The condition in which a plant bears only one kind of leaf. [<ISO- + Gk. *phyllon* leaf] — **i'so·phyl'lous** *adj.*

i·so·pi·es·tic (ī'sō·pī·es'tik) *adj.* Showing equal

also called *semastology, semiotics.* GENERAL SEMANTICS. 3 Loosely, trickery, especially by adulteration or [illegible] meaning within a word; amphibology.

-phore (sem'ə-fôr, -fōr) *n.* An [illegible] for making signals, as with [illegible] arms, disks, [illegible] or lanterns. 2 To send by [illegible]phore. [<F *-phore* <Gk. *-phoros* a sign + *pherein* carry] —sem'·[illegible] (-fôr'ik, [illegible]) or ·i·cal *adj.*

sé·mang (sə·mäng') *n.* A port of [illegible]ra Java: also [illegible]ng.



SEMAPHORE
a. Clear. *b.* Approach. *c.* Stop.

se·mas·i·ol·o·gy (si·maz'ē·ol'ə·jē, -zē-) *n.* [illegible]ics (def. 2). [<Gk. *sēmasia* the signification of a word <*sēma* sign + -LOGY] —**se·mas·i·o·log·i·cal** (si·mā'sē·ə·loj'i·kəl, -zē-) *adj.*

se·mat·ic (si·mat'ik) *adj.* Of the nature of a [illegible] warning; in animal coloration, serving [illegible]inguish as a means of recognition or [illegible]. [<Gk. *sēma, -atos* a sign]

sem·blable (sem'blə·bəl) *adj.* 1 Resembling; [illegible]. 2 Apparent; not real. —*n.* A thing [illegible]bling another thing. Also **sem'bla·tive.** [<OF <*sembler.* See SEMBLANCE.]

sem·blance (sem'bləns) *n.* 1 A mere show [illegible]out reality; pretense. 2 Outward appearance; look; aspect. 3 A pictorial representation; likeness; resemblance. See synonyms under PRETENSE. [<OF <*sembler* seem <L *similare, similare* simulate <*similis* like]

sem·ble (sem'bəl) *v.t.* **·bled, ·bling** It seems; it would seem; used only in law, and generally in abbreviated form, **sem.** or **semb.** [<F, it seems <*sembler.* See SEMBLANCE.]

se·mé (sə·mā', *Fr.* sə·mā') *adj. Her.* Strewn or [illegible]ered over with small bearings, as fleurs-de-lis: powdered. [<OF, pp. of *semer* sow <L *seminare* <*semen* a seed]

sem·el·o·gy (sē'mi·ol'ə·jē, sē'mē-), **se·mei·ot·ics** (sē'mī·ot'iks, sē'mē-), etc. See SEMIOLOGY, [illegible]OTICS, etc.

Sem·e·le (sem'ə·lē) In Greek mythology, the [illegible]ther of Dionysus by Zeus: she was destroyed by lightning when she asked to see [illegible]us as he appeared to the gods.

se·meme (sē'mēm) *n. Ling.* The meaning of a [illegible]rpheme. [<Gk. *sēma* a sign; on analogy with *phoneme*]

se·men (sē'mən) *n.* 1 The impregnating fluid of male animals. 2 Seed. [<L <*serere* sow]

se·mes·ter (si·mes'tər) *n.* A college half-year; [illegible]ce, a period of instruction, usually lasting [illegible]r or 18 weeks. [<G <L *(cursus) semestris* (a period) of six months <*sex* six + *mensis* a month] —**se·mes'tral** *adj.*

semi (sem'ē) *n. pl.* **sem·is** *Colloq.* 1 *U.S.* A [illegible]trailer. 2 *Brit.* A semi-detached house. —**the semis** *Colloq.* The semifinal round of [illegible]petition in a sports competition.

semi- *prefix* 1 Half; partly; not fully: *semi-automatic, semicivilized.* 2 Exactly half: *semicircle.* 3 Occurring twice (in the period specified): *semiweekly.* [<L]

Semi-, meaning not fully, partially, or partial, is found in solidemes and hyphemes, as in the list beginning at the foot of this page.

sem·i·an·nu·al (sem'ē·an'yōō·əl) *adj.* Issued or occurring twice a year; half-yearly. —*n.* A publication issued twice a year. —**sem'i·an'·[illegible]al·ly** *adv.*

sem·i·a·quat·ic (sem'ē·ə·kwat'ik, -kwot'ik) *adj. Biol.* Adapted for living or growing near water, as certain types of plants and animals.

semi-au·to·mat·ic (sem'ē·ô'tə·mat'ik) *adj.* Only partly automatic: said especially of guns which are self-loading but not self-firing.

sem·i·breve (sem'ē·brēv') *n. Music* A note equal to half a breve; a whole note.

sem·i·cell (sem'ē·sel') *n. Biol.* Half of a complete cell, usually joined to the other half by an isthmus, as in certain green algae. Compare DESMID.

sem·i·cen·ten·ni·al (sem'ē·sen·ten'ē·əl) *adj.* Occurring or celebrated at the end of fifty years from some event. —*n.* The fiftieth anniversary of an event, or its celebration.

sem·i·cir·cle (sem'ē·sûr'kəl) *n.* 1 A half-circle; an arc or a segment of 180°. 2 Anything formed or arranged in a half-circle. —**sem'i·cir'·cu·lar** *adj.*

semicircular canal *Anat.* One of the three tubular structures in the inner ear of most vertebrates, which together serve as the organ of balance. See illustration under EAR.

sem·i·cir·cum·fer·ence (sem'ē·sər·kum'fər·əns, -frəns) *n.* One half of a circumference.

sem·i·civ·i·lized (sem'ē·siv'ə·līzd) *adj.* Half or partly civilized.

semi·co·lon (sem'ē·kō'lən) *n.* A mark (;) of punctuation, indicating a greater degree of separation than the comma.

sem·i·con·duc·tor (sem'ē·kən·duk'tər) *n. Physics* 1 One of a class of crystalline solids, as germanium, silicon, and lead sulfide, which are electronic conductors at ordinary temperatures; used in the manufacture of transistors. 2 Any substance or material having an electrical conductivity intermediate between metals and dielectrics.

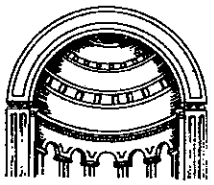
sem·i·con·scious (sem'ē·kon'shəs) *adj.* Partly conscious; half-conscious.

sem·i·de·tached (sem'ē·di·tacht') *adj.* Joined to another on one side only: said of two houses built side by side with one common wall.

sem·i·di·am·e·ter (sem'ē·di·am'ə·tər) *n.* A radius; half of a diameter.

sem·i·di·ur·nal (sem'ē·dī·ûr'nəl) *adj.* 1 Pertaining to or continuing during a half-day; occurring or accomplished in a half-day, or once each half-day. 2 Designating either half of the arc described by a heavenly body during its rising or setting. [<SEMI- + DIURNAL]

sem·i·dome (sem'ē·dōm') *n. Archit.* A roof structure resembling a portion, approximately half, of a dome divided vertically.


SEMIDOME

sem·i·el·lip·ti·cal (sem'ē·i·lip'ti·kəl) *adj.* Having the form of half of an ellipse that has been divided along either diameter.

sem·i·fi·nal (sem'ē·fī'nəl) *n.* 1 A competition which precedes the final in a list of sporting events. 2 One of two competitions in a tournament, the winners of each meeting in the final. —*adj.* Next before the final. —**sem'i·fi'nal·ist** *n.*

sem·i·flu·id (sem'ē·flōō'id) *adj.* Fluid, but thick and viscous. —*n.* A thick, viscous fluid. —**sem'i·flu·id'ic** (-flōō·id'ik) *adj.*

sem·i·liq·uid (sem'ē·lik'wid) *adj.* Half liquid. —*n.* A partly liquid substance.

sem·i·lu·nar (sem'ē·lōō'nər) *adj.* Resembling or shaped like a half-moon; crescentic. Also **sem'i·lu'nate** (-lōō'nāt).

semilunar bone *Anat.* The middle bone in the upper row of wrist bones.

semilunar valve *Anat.* One of the crescent-shaped pockets at the entrances to the aorta and to the pulmonary artery respectively: their function is to prevent the backward flow of blood.

sem·i·mo·bile (sem'ē·mō'bēl) *adj.* Partly mobile: said especially of military units not fully equipped with motor vehicles.

sem·i·month·ly (sem'ē·munth'lē) *adj.* Taking place twice a month. —*n. pl.* **·lies** A publication issued twice a month. —*adv.* At half-monthly intervals.

sem·i·mute (sem'ē·myōōt') *adj.* Having imperfectly developed or partially lost speech.

sem·i·nal (sem'ə·nəl) *adj.* 1 Pertaining to or containing seeds, germs, or primal elements. 2 Having productive power; germinal; propagative. 3 Not developed; embryonic; rudimentary. [<OF <L *seminalis* <*semen, seminis* semen, a seed] —**sem'i·nal·ly** *adv.*

sem·i·nar (sem'ə·när) *n.* 1 A group of advanced students at a college or university, meeting regularly and informally with a professor for discussion of research problems: 2 The course thus conducted. [<G <L *seminarium.* See SEMINARY.]

sem·i·nar·y (sem'ə·ner'ē) *n. pl.* **·nar·ies** 1 A special school, as of theology; also, a school of higher education. 2 A seminar. 3 The place where anything is nurtured. 4 A seminary priest. —*adj.* 1 Seminal. 2 Pertaining to a seminary. [<MF *séminaire* <L *seminarium* a seed plot, orig. neut. of *seminarius* seminal <*semen, seminis* a seed, semen]

sem·i·na·tion (sem'ə·nā'shən) *n.* 1 The act of sowing or spreading; dispersion of seeds. 2 Propagation. [<L *seminatio, -onis* <*semen, seminis* a seed, semen]

sem·i·nif·er·ous (sem'ə·nif'ər·əs) *adj.* 1 Carrying or producing semen. 2 Seed-bearing. [<L *semen, seminis* a seed, semen + *ferre* bear]

sem·i·niv·o·rous (sem'ə·niv'ər·əs) *adj.* Feeding on seeds. [<L *semen, seminis* a seed, semen + -VOROUS]

Sem·i·nole (sem'ə·nōl) *n.* One of a Florida tribe of North American Indians of Muskhogean linguistic stock, an offshoot of the Creeks: now chiefly in Oklahoma, a remnant remaining in Florida. [<Muskhogean (Creek) *Simanóle,* lit., a separatist, a runaway]

sem·i·of·fi·cial (sem'ē·ə·fish'əl) *adj.* Having official authority or sanction; official to a certain extent. —**sem'i·of·fi'cial·ly** *adv.*

se·mi·ol·o·gy (sē'mē·ol'ə·jē, sē'mī-) *n.* 1 The science that relates to sign language. 2 *Med.* Symptomatology. 3 The use of signs in signaling. Also spelled *semetology.* [<Gk. *sēmeion,* dim. of *sēma* a mark + -LOGY]

sem·i·o·paque (sem'ē·ō·pāk') *adj.* Half-opaque; translucent but not transparent.

se·mi·ot·ic (sē'mē·ot'ik, sē'mī-) *adj.* 1 Of or pertaining to semantics (def. 2). 2 *Med.* Relating to symptomatology. Also spelled *semeiotic.* Also **se'mi·ot'i·cal.** [<Gk. *sēmeiōtikos* <*sēmeion.* See SEMIOLOGY.]

se·mi·ot·ics (sē'mē·ot'iks, sē'mī-) *n. pl. (construed as singular)* 1 Semantics (def. 2). 2 *Med.* Symptomatology. Also spelled *semeiotics.* [<Gk. *sēmeiōtikos.* See SEMIOTIC.]

sem·i·o·vip·a·rous (sem'ē·ō·vip'ər·əs) *adj.* Giving birth to imperfectly developed offspring, as a marsupial.

Se·mi·pa·la·tinsk (sye·mē·pə·lä'tyinsk) A city of eastern Kazakh S.S.R., on the Irtysh.

sem·i·pal·mate (sem'ē·pal'māt, -mit) *adj. Ornithol.* Having the toes connected by webs for less than half their length, as many shore birds. Also **sem'i·pal'mat·ed.**

semipalmated plover A common plover (*Charadrius semipalmatus*) of the Atlantic coast, which breeds only in the Arctic.

sem·i·par·a·sit·ic (sem'ē·par'ə·sit'ik) *adj. Biol.*

semiaccomplishment	**semiarchitectural**	**semibleached**	**semiclosure**	**semiconversion**	**semidiaphanous**	**semifailure**
semiacquaintance	**semiarid**	**semiblind**	**semicoagulated**	**semicooperative**	**semidigested**	**semifatalistic**
semiaffectionate	**semiatheist**	**semiblunt**	**semicollapsible**	**semicured**	**semidirect**	**semifeudalism**
semiagricultural	**semiattached**	**semibolled**	**semicolonial**	**semicylindrical**	**semidomesticated**	**semifictional**
semialcoholic	**semi-autonomous**	**semibourgeois**	**semicomplete**	**semidangerous**	**semidry**	**semifinished**
semiallegiance	**semi-autonomy**	**semichannel**	**semiconceal**	**semidarkness**	**semi-Empire**	**semifit**
semianarchist	**semibald**	**semichaotic**	**semiconfident**	**semideaf**	**semienclosed**	**semifitting**
semiangular	**semibarbarian**	**semichivalrous**	**semiconfinement**	**semidelirious**	**semierect**	**semifixed**
semianimal	**semibarbarism**	**semi-Christian**	**semiconformist**	**semidenatured**	**semieremitical**	**semiflexed**
semianimated	**semibarbarous**	**semiclerical**	**semiconnection**	**semidependent**	**semiexposed**	**semifluctuating**
semiarborescent	**semibarren**	**semiclosed**	**semiconservative**	**semidestructive**	**semiextinction**	**semiforeign**

met·a·cen·ter (met′ə·sen′tər) *n. Physics* That point in a floating body slightly displaced from equilibrium through which the resultant upward pressure of the fluid always passes; the center of gravity of the unsubmerged portion of a floating body. Also **met′a·cen′tre.** — **met′a·cen′tric** *adj.*

met·a·chem·is·try (met′ə·kem′is·trē) *n.* The chemistry of elements and compounds which yield exceptionally large amounts of energy in relation to their mass. — **met′a·chem′i·cal** *adj.*

met·a·chro·ma·tism (met′ə·krō′mə·tiz′əm) *n.* An alteration in color; specifically, such alteration due to heating or cooling. — **met′a·chro·mat′ic** (-krō·mat′ik) *adj.*

Met·a·com·et (met′ə·kom′it) Indian name of American Indian chief, King Phillip.

met·a·gal·ax·y (met′ə·gal′ək·sē) *n. pl.* **·ax·ies** *Astron.* The entire material universe, regarded especially as a system including all the galaxies.

met·age (mē′tij) *n.* 1 Measurement. 2 The price charged for measurement. 3 A general term for the tolls formerly exacted by the corporation of London over a part of the Thames above and below the city. [<METE¹]

met·a·gen·e·sis (met′ə·jen′ə·sis) *n. Biol.* A type of reproduction in which a series of generations of unlike forms comes between the egg and the parent type; alternation of generations. — **met′a·ge·net′ic** (-jə·net′ik) *adj.*

me·tag·na·thous (mə·tag′nə·thəs) *adj. Ornithol.* Having the points of the mandibles crossing each other, as in the crossbill. [< META- + -GNATHOUS] — **me·tag′na·thism** *n.*

met·ag·nos·tic (met′ag·nos′tik) *adj.* Beyond the knowledge, whether of the sense or the understanding, of man as he is at present constituted; metaphysical. — *n.* A person holding a belief in the existence of a Supreme Being who transcends human knowledge. [<META- + Gk. *gnōstikos* knowing] — **met′ag·nos′ti·cism** *n.*

met·al (met′l) *n.* 1 An element that forms a base by combining with a hydroxyl group or groups. It is usually hard, heavy, lustrous, malleable, ductile, tenacious, and a good conductor of heat and electricity. 2 A composition of some metallic element; also, an alloy; generally with a qualifying word. 3 Cast iron while melted. 4 Broken stone for road surfaces or for railway ballast: also called **road metal.** 5 *Her.* Gold *(or)* or silver *(argent)* tincture. 6 Molten glass. 7 The weight of the projectiles that a warship's guns can throw at once. 8 *Printing* Type metal; also, composed type. 9 The constituent material of anything; essential quality. — **noble metal** A metal that does not readily oxidize in the open air, as gold, silver, and platinum. — **white metal** Any one of the various white alloys, such as pewter, used for making ornaments, small castings, etc; specifically, a soft, smooth, malleable, copper–zinc alloy of exceptional antifrictional properties used to form the bearing surface in the crankshaft and connecting-rod bearings in most internal-combustion engines. — *adj.* Consisting of or pertaining to metal. — *v.t.* **·aled** or **·alled, ·al·ing** or **·al·ling** To furnish or cover with metal. ◆ Homophone: *mettle.* [<OF <L *metallum* mine <Gk. *metallon.* Doublet of MEDAL.]

met·a·lin·guis·tics (met′ə·ling·gwis′tiks) *n.* An area of linguistic study concerned with the interrelationship of the structure and meaning of the language of a society and other aspects of its culture, such as the social system.

met·al·ist (met′l·ist) *n.* 1 One who works with or has special knowledge of metals. 2 An advocate of metallic money as against a paper currency. Also **met′al·list.**

met·al·ize (met′l·īz) *v.t.* **·ized, ·iz·ing** To turn into or treat with metal. Also **met′al·lize,** *Brit.* **met′al·ise.**

me·tal·lic (mə·tal′ik) *adj.* 1 Being, containing, yielding, or having the characteristics of a metal: a *metallic* voice; *metallic* luster. 2 Pertaining to a metal. — **me·tal′li·cal·ly** *adv.*

metallic soap A soapy, waxlike material made by combining the salts of certain metals, as lead or aluminum, with various fatty acids: used in the textile, varnish, and paint industries.

met·al·lif·er·ous (met′ə·lif′ər·əs) *adj.* Yielding or containing metal.

met·al·line (met′ə·lin, -līn) *adj.* 1 Relating to, having the properties of, or resembling metal. 2 Impregnated with metals or metallic salts.

met·al·log·ra·phy (met′ə·log′rə·fē) *n.* 1 The science that treats of metallic substances; also, a treatise on metals. 2 Microscopic study of the structure of metals and alloys. [<Gk. *metallon* mine, metal + -GRAPHY] — **me·tal·lo·graph·ic** (mə·tal′ə·graf′ik) *adj.*

met·al·loid (met′ə·loid) *n.* One of those nonmetallic elements that resemble the metals in some of their properties, as arsenic and antimony. — *adj.* 1 Resembling a metal. 2 Of, pertaining to, or having the properties of a metalloid. Also **met′al·loi′dal.**

me·tal·lo·ther·a·py (mə·tal′ō·ther′ə·pē) *n.* Medical treatment by the use of metals, especially metal salts. [<Gk. *metallon* mine, metal + THERAPY]

met·al·lur·gy (met′ə·lûr′jē) *n.* The art or science of extracting a metal or metals from ores, as by smelting, reducing, refining, alloying, electrolysis, etc. [<NL *metallurgia* <Gk. *metallourgos* working in mines <*metallon* mine + *-ergos* working] — **met′al·lur′gic** or **·gi·cal** *adj.* — **met′al·lur′gi·cal·ly** *adv.* — **met′al·lur′gist** *n.*

met·al·work (met′l·wûrk′) *n.* 1 Articles made of metal. 2 Metalworking.

met·al·work·ing (met′l·wûr′king) *n.* The making or the business of making things out of metal. — **met′al·work′er** *n.*

met·a·math·e·mat·ics (met′ə·math′ə·mat′iks) *n.* That branch of mathematics which is concerned with the formalized and rigorously logical treatment of pure symbols, having regard only to internal consistency and the establishment of absolute proofs of the validity of a given set of axioms, postulates, theorems, etc., within a mathematical system. — **met′a·math′e·mat′i·cal** *adj.*

met·a·mer (met′ə·mər) *n. Chem.* A compound or substance exhibiting metamerism. [<META- + Gk. *meros* part] — **met′a·mer′ic** (-mer′ik) *adj.*

met·a·mere (met′ə·mir) *n. Biol.* One of the series of homologous segments that form the body of a chordate or articulate animal, as a worm; a somite. Also **me·tam·er·on** (mə·tam′ər·on). [<META- + -MERE] — **met′a·mer′ic, me·tam′er·al** *adj.* — **met′a·mer′i·cal·ly** *adv.*

me·tam·er·ism (mə·tam′ə·riz′əm) *n.* 1 *Chem.* A variety of isomerism in which the compounds have not only the same percentage of composition, but also the same molecular weight. 2 *Biol.* Disposition in metameres; the state of being a metamere; also, an example of this. Also **me·tam′er·y.**

met·a·mor·phic (met′ə·môr′fik) *adj.* 1 Producing metamorphism. 2 Pertaining to, caused by, or exhibiting metamorphism. Also **met′a·mor′phous.**

met·a·mor·phism (met′ə·môr′fiz·əm) *n.* 1 *Geol.* The changes in the composition and texture of rocks caused by earth forces accompanied by heat, pressure, moisture, etc. 2 Any metamorphosis. [See METAMORPHOSIS]

met·a·mor·phop·si·a (met′ə·môr·fop′sē·ə) *n. Pathol.* A defect in vision which makes objects appear distorted. [<NL <Gk. *metamorphōsis* transformation + *ōps* eye]

met·a·mor·phose (met′ə·môr′fōz) *v.t.* **·phosed, ·phos·ing** 1 To change the form of; transmute. 2 To change by metamorphism. Also **met′a·mor′phize.** See synonyms under CHANGE. [<F *métamorphoser*]

met·a·mor·pho·sis (met′ə·môr′fə·sis) *n. pl.* **·pho·ses** (-fə·sēz) 1 A passing from one form or shape into another; transformation with or without change of nature: especially applied to change by means of witchcraft, sorcery, etc. 2 Complete transformation of character, purpose, circumstances, etc.; also, a person or thing metamorphosed. 3 *Biol.* A change in form, structure, or function in an organism resulting from development; transformation; specifically, the series of marked external changes through which an individual passes after leaving the egg and before attaining sexual maturity, as the larva, pupa, and imago of an insect. Compare METAGENESIS. 4 *Bot.* The varied development of plant organs of the same morphological value, such development resulting from their adaptations of different functions; also **met′a·mor′phy.** 5 *Pathol.* A morbid change of the elements of tissues into another form of structure. 6 The changes in form going on in living tissues, blood corpuscles, etc. [<L <Gk. *metamorphōsis* <*metamorphoein* transform <*meta-* beyond + *morphē* form]

met·a·neph·ros (met′ə·nef′ros) *n. Biol.* The posterior one of three similar tubular organs in connection with the genitourinary apparatus. It develops into the permanent kidney. [<NL <META- + Gk. *nephros* kidney]

met·a·phase (met′ə·fāz) *n. Biol.* The middle stage of mitotic cell division, during which the chromosomes split along the equatorial plane between the two poles of the spindle. [<META- + -PHASE]

met·a·phor (met′ə·fôr, -fər) *n.* A figure of speech in which one object is likened to another by speaking of it as if it were that other: distinguished from *simile* by not employing any word of comparison, such as "like" or "as." See synonyms under ALLEGORY, SIMILE. — **mixed metaphor** Figurative language in which incongruous, and often contradictory, metaphors are used; confusion of figurative with plain statement. [<F *métaphore* <L *metaphora* <Gk. <*metapherein* <*meta-* beyond, over + *pherein* carry]. — **met′a·phor′ic** (-fôr′ik, -for′ik) or **·i·cal** *adj.* — **met′a·phor′i·cal·ly** *adv.*

met·a·phos·phate (met′ə·fos′fāt) *n. Chem.* A salt of metaphosphoric acid.

met·a·phos·phor·ic acid (met′ə·fos·fôr′ik, -for′ik) *Chem.* The glacial phosphoric acid of commerce, HPO_3, usually sold in the form of transparent sticks. It is obtained by heating orthophosphoric acid.

met·a·phrase (met′ə·frāz) *v.t.* **·phrased, ·phras·ing** 1 To translate word for word. 2 To alter the wording of. — *n.* 1 A literal translation. 2 A phrase in response; retort. 3 A school exercise consisting in the rendering of a piece of poetry into prose or of prose into verse. [<Gk. *metaphrasis* <*metaphrazein* paraphrase <*meta-* beyond + *phrazein* phrase]

met·a·phrast (met′ə·frast) *n.* One who renders poetry into prose or prose into poetry, changes the meter of verse. [<Gk. *metaphrastēs*] — **met′a·phras′tic** or **·ti·cal** *adj.*

met·a·phys·ic (met′ə·fiz′ik) *n.* Metaphysics. — *adj.* Metaphysical.

met·a·phys·i·cal (met′ə·fiz′i·kəl) *adj.* 1 Of pertaining to metaphysics. 2 Treating of versed in metaphysics. 3 Beyond or abo the physical or experiential; pertaining or being of the essential nature of reali transcendental. 4 Dealing with abstractio apart from, or opposed to, the practic 5 Designating certain poets of the 1 century, notably Cowley and Donne, wh verses were characterized by complex, in lectualized imagery: term originating w Dr. Samuel Johnson. [See METAPHYSICS] **met′a·phys′i·cal·ly** *adv.*

metaphysical healing Christian Science.

met·a·phy·si·cian (met′ə·fi·zish′ən) *n.* skilled or versed in metaphysics. Also **me phys′i·cist.**

met·a·phys·ics (met′ə·fiz′iks) *n. pl. (consti as singular)* 1 The systematic study or scie of the first principles of being and of kno edge; the doctrine of the essential nature fundamental relations of all that is 2 Speculative philosophy in the wide se 3 The principles of philosophy as applie the methodology of any particular scie 4 Mental science in general; psychology. popular use, abstruse and bewildering cussion. Also *metaphysic.* [<Med. L *m physica* <Med. Gk. <*ta meta ta physika* (works) after the physics; in ref. to Aristo ontological treatises, which came after *Physics*]

met·a·pla·si·a (met′ə·plā′zhē·ə) *n. Biol.* direct transformation of one kind of t into another, as cartilage into bone. [- <Gk. *meta-* beyond + *plassein* mold]

me·tap·la·sis (mə·tap′lə·sis) *n. Biol.* The p of completed growth in the life cycle o organism; maturity. [<NL]

met·a·plasm (met′ə·plaz′əm) *n.* 1 *Biol.* lifeless, non-protoplasmic material of a as inclusions of fats and carbohydrates. reversal or change in the order of the l or syllables of a word. [<L *metapl* <Gk. *metaplasmos* <*meta-* beyond + *pl* mold] — **met′a·plas′mic** *adj.*

met·a·po·di·um (met′ə·pō′dē·əm) *n. pl.* (-dē·ə) 1 The posterior part of the fo

APPENDIX 'C'

DEFINITIONS FOR THE FOLLOWING WORDS OR PHRASES (from H. J. Gray, A New Dictionary of Physics (H. J. Gray & Alan Isaacs eds. 1975)):

1. **GLOW DISCHARGE. (Id. at 236.).**
2. **GAS-DISCHARGE TUBE. (Id. at 230).**

A New Dictionary of Physics

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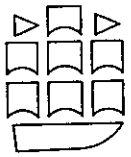

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Notes

An asterisk indicates a cross reference.
An entry having an initial capital letter is either a proper name or a trade name.
Syn. is an abbreviation for "synonymous with".
All other abbreviations will be found in the Tables of SI units (page 589) and the Table of symbols (pages 597 and 598).

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in an environment quite distinct from that of the operator. It is most commonly employed for working with sources of alpha particles and thus, because of their low power of penetration, the walls of the box are largely glass. It may also be used for working with beta-sources and for work in environments with special properties (e.g. controlled humidity, sterilized, or inert). It is usual for the pressure to be maintained slightly above atmospheric to reduce the possibility of contamination from without.

glow discharge An electric discharge through a gas, usually at a relatively low pressure, in which the gas becomes luminous. *See* gas-discharge tube.

gnomonic projection From a point within a crystal (the pole of projection) lines are drawn normal to the crystal faces (or sets of planes in the crystal) and these produced will meet any plane in a pattern of points which is the gnomonic projection of the crystal on that plane.

Goddard, Robert Hutchings (1882–1945), Amer. physicist who made the first rocket capable of flying in space, using a liquid fuel and liquid oxygen.

gold-leaf electroscope *See* electroscope.

gold point The melting point of pure gold taken as a fixed point (1064·43° C) on the *International practical temperature scale.

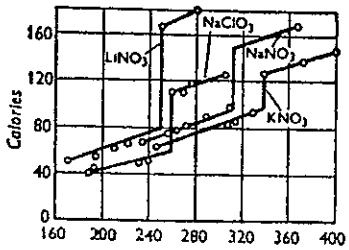
Goldstein, Eugen (1850–1931), German physicist. In 1886 he discovered canal rays, visible behind a perforated cathode in a *gas-discharge tube and so called from their apparent origin in these channels. He had earlier investigated and named cathode rays (1876) and he claimed to have deflected them by an electrostatic field.

gon *Syn.* grade. A unit of angle (Germany) equal to $\frac{1}{100}$ of a right angle.

goniometry The measurement of interfacial angles for the comparison of crystals of different development. The *contact goniometer* consists of two flat bars pivoted together like a pair of scissors and capable of being clamped in any position by means of the screw pivot. The angle between the bars is read off from a graduated semicircle (Carangcot, 1780). The crystal is fitted between the two bars and the angle between them is read off on the scale. In the case of small crystals, some type of reflecting goniometer is used (Wollaston, 1809). A fixed mirror is illuminated from a collimator so that part of the parallel beam falls on the crystal, which is fixed on an axis parallel to the mirror and a short distance above it, and is so adjusted that the edge of which the facial angle is to be measured, is parallel to the axis. An image of a horizontal slit is seen reflected in the mirror and the crystal face; the latter is rotated until the two images coincide to the axis is taken. The crystal is then rotated on the axis until coincidence is similarly obtained for the image reflected in the second face, i.e. when the second face is parallel to that originally occupied by the first face. The difference between the readings on the graduated scale gives the normal crystallographic angle between the two faces. Similarly, all the interfacial angles in a given zone can be found by further rotation of the crystal. The axis may be horizontal or vertical.

goniophotometer *See* photometry.

Goodwin and Kalmus's latent heat determinations The method of mixtures was used to find the *specific latent heat of fusion of various salts. A known mass of the salt contained in a sealed platinum vessel is heated in an electric furnace to a known high temperature and then dropped into a calorimeter containing water, or, for higher temperatures, aniline. The amount of heat liberated is found as usual from the rise in temperature of the liquid in the calorimeter, and the experiment is performed many times with the substance heated to different initial temperatures extending over a range of about 50° C both above and below the melting point of the substance. The amount of heat (Q) required to raise the temperature of 1 g of the substance from room temperature to its initial temperature can thus be calculated and plotted against the initial temperature to give curves of the type shown. The temperature corresponding to the discontinuity is the melting point and the vertical line gives the specific latent heat of fusion of the substance. The method has been considerably improved by *Awbery and Griffiths.



Method of determining latent heat of fusion

G-parity A quantum number associated with *elementary particles that have zero *baryon number and *strangeness. It is conserved in *strong interactions only.

grade *See* gon.

graded-base transistor *See* drift transistor.

gradient (1) Of a graph at any point. The slope of the tangent to the graph at that point as measured by the tangent of the angle it makes with the

(2) (grad) The gradient of a sca at a point is the *vector pointin of the greatest increase in the sca (i.e. perpendicular to the level su in question). It has components alc axes that are the partial derivativ function with respect to each vari

$$\text{grad}\, f = \nabla f = i f_x + j f_y$$

where ∇ is the differential operat are unit vectors along the x-, y-, a field is the negative gradient of el *See* potential gradient.

grading shield *Syn.* arcing-shiel An *arcing-ring designed to impr distribution across the units of a st when used with an a.c. supply.

gradiometer *See* free fall.

Graetz number Symbol: (G_z). coefficient of importance in the dynamics.

$$(G_z) = q_m c_p / \lambda l$$

where q_m = mass flow rate, c_p capacity at constant pressure, λ ductivity, and l = a characteristic

Graham, Thomas (1805–1869), Bri famous for his work on the absc osmosis, and diffusion (*See* Gra introduced the term *colloid.

Graham's law of diffusion (1846 efflux of different gases through a same temperature and pressure ar portional to the square roots of Knudsen showed that the law is the mean free path in the issuing ten times the diameter of the hole.

Graham's pendulum (G. Graham, 1 compensated pendulum.

grain In metallurgy, one of the s regions in a polycrystalline material with lens or microscope) after suita of the surface by polishing and etch

gramme (or gram) $\frac{1}{1000}$ of the m national prototype *kilogramme.

gramme-atom or -molecule The fo a *mole.

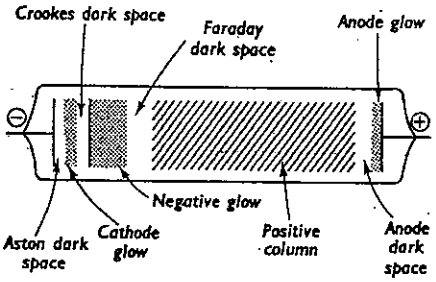
Gramme ring An electromagnet ring as its core—sometimes used armature of an electric motor or ge

gas-cooled reactor A type of thermal *nuclear reactor in which a gaseous *coolant is used. In the *Magnox (Mark I) reactors the coolant is carbon dioxide and the outlet temperature is about 350° C: natural uranium fuel is used with a graphite *moderator, the fuel elements being encased in Magnox. In the *advanced gas-cooled* reactors (Mark II), the fuel is ceramic uranium dioxide encased in stainless steel. The same coolant and moderator as in the Mark I type are used, but the outlet temperature is considerably higher—usually about 600° C.

gas-discharge tube An *electron tube in which the presence of gaseous molecules contributes significantly to the characteristics of the tube. Under normal conditions a gas is a poor conductor of electricity, but if a sufficiently high electric field is applied conduction can occur. If two plane electrodes are sealed in a tube and a potential applied between them the gas can conduct as a result of an external ionizing agent, such as *cosmic rays or *ultraviolet radiation. If the ionizing agent is removed the current ceases. Under certain conditions the discharge can be self-sustaining and independent of the external agent.

In self-sustaining discharges the ions and electrodes initially formed in the tube are accelerated to the electrodes and cause further ionization along their path. Electrons are also produced by *secondary emission at the electrodes. Electrons and ions are removed at the *anode and *cathode respectively and by recombination. A stable state can be reached when the rate of production of ions and electrons is equal to the rate at which they are removed. The characteristics of the discharge depend on the gas, the pressure, the electric field, and the shapes and materials of the electrodes.

The most common type of discharge is the *glow discharge* characterized by several luminous regions in the tube (*see* diagram). In the cathode region of the tube the electrons are emitted from the cathode as a result of ion bombardment (*see* secondary emission). They are accelerated towards the anode and for a short distance they have not enough energy to ionize the atoms of gas or to excite them. The positive ions moving towards the cathode have, in this region, a high velocity and



Gas-discharge tube

have returned to their *ground state by the time they reach this region. Consequently it emits no radiation and is called the *Aston dark space*. The *cathode glow* is a luminous region near the cathode where positive ions that have been excited by electrons return to their ground state with emission of luminous radiation.

In the *Crookes dark space* electrons moving from the cathode have gained enough energy to ionize atoms but the electrons thus produced do not have sufficient energy to excite atoms. Consequently the region produces little radiation.

In the *negative glow* the electrons have gained sufficient energy to cause excitation and the excited atoms return to their ground state with emission of radiation. A small amount of the radiation is also produced by recombination of ions and electrons in this region. In passing the region of the negative glow the electrons lose much of their energy and in the *Faraday dark space* they again have insufficient energy to excite or ionize the gas. There is then a large luminous region (the *positive column*) in which the gas is excited and emits radiation. The relative sizes of the negative glow and positive column depend on the gas pressure which determines the *mean free path of charged particles. At pressures below about 0·1 mmHg the positive column often displays *striations*, i.e. alternate dark and light regions caused by the electrons alternately gaining and losing energy in their journey to the anode.

In a glow discharge the potential drop across the tube is independent of the current and does not vary uniformly down the length of a glow discharge. Most of the potential drop occurs between the cathode and the negative glow. This drop is called the *cathode fall* and depends on the material of the cathode as well as the nature of the gas. The current increases with gas pressure. When the current increases to a certain point the glow covers the whole of the cathode and beyond this point the voltage drop increases with current. This is called an *abnormal glow discharge*.

Two other types of discharge are distinguished. In an *arc discharge* the current density is very high and thermionic emission from the cathode can occur as well as secondary emission. In an arc discharge the voltage drop falls as the current increases. Arc discharges can occur over a very wide range of pressures and the term is applied to the large number of discharges that are not very well understood.

The *Townsend discharge* occurs at lower currents than the glow discharge and the voltage increases with increasing current. At low current densities the potential falls uniformly down the tube and there is a uniform luminous region between the two electrodes.

When discharges occur at low pressures the ions and electrons lose little energy in collision with gas molecules. Electrons emitted from the cathode by the impact of positive ions are called

lity of recombining with electrons. ns produced further down the tube to their *ground state by the time s region. Consequently it emits no is called the *Aston dark space*. The a luminous region near the cathode : ions that have been excited by n to their ground state with emission diation.

es dark space electrons moving from ve gained enough energy to ionize lectrons thus produced do not have gy to excite atoms. Consequently luces little radiation.

ive glow the electrons have gained gy to cause excitation and the return to their ground state with adiation. A small amount of the so produced by recombination of rons in this region. In passing the negative glow the electrons lose energy and in the *Faraday dark* in have insufficient energy to excite as. There is then a large luminous *sitive column*) in which the gas is its radiation. The relative sizes of low and positive column depend ssure which determines the *mean arged particles. At pressures below g the positive column often displays alternate dark and light regions electrons alternately gaining and their journey to the anode.

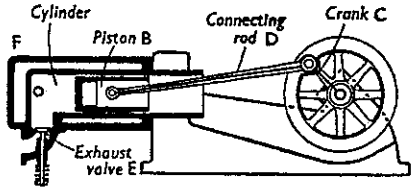
ischarge the potential drop across lependent of the current and does rmly down the length of a glow st of the potential drop occurs thode and the negative glow. This he *cathode fall* and depends on the cathode as well as the nature of the t increases with gas pressure. When reases to a certain point the glow le of the cathode and beyond this ge drop increases with current. This *ormal glow discharge*.

pes of discharge are distinguished. *harge* the current density is very nionic emission from the cathode ll as secondary emission. In an arc voltage drop falls as the current discharges can occur over a very pressures and the term is applied nber of discharges that are not very l.

d discharge occurs at lower currents lischarge and the voltage increases current. At low current densities lls uniformly down the tube and rm luminous region between the

urges occur at low pressures the ons lose little energy in collision ules. Electrons emitted from the impact of positive ions are called *cathode rays*. They gain sufficient kinetic energy to produce *X-rays in their collision with the anode. If holes are bored in the cathode positive ions can pass through and cause the glass to fluoresce. These are known as *canal rays*.

gas engine An internal combustion engine using air mixed with about one-eighth of its volume of coal or natural gas, admitted through a valve to the cylinder on the left of the piston B, connected by the rod D to the crank C. The ignition is usually



Gas engine

by a spark, water circulating in the jacket F to prevent the cylinder becoming too hot. The exhaust valve E of the mushroom type is operated by a cam on a side shaft driven by the crank shaft C.

gaseous ions Positively or negatively charged systems formed in gases by the action of *ionizing radiation (e.g. X-rays); when an electric field is applied across the gas, the motion of the gaseous ions under the action of the field conveys an ionization current across the gas. They differ from electrolytic ions in the fact that they are not permanent, but recombine to form neutral molecules within a short time after the ionizing radiation has been cut off. In moist gases, and in some dry gases, the ion consists of an aggregation of molecules clustered around the original charged molecule or atom. *See* conduction in gases.

gas-filled relay *See* thyratron.

gas-filled tube An *electron tube containing a gas (or vapour, e.g. mercury vapour) in sufficient quantity to ensure that, once ionization of the gas has taken place, the electrical characteristics of the tube are determined entirely by the gas.

gas focusing It is possible to focus the beam in a cathode-ray or other electron-beam tube by allowing a trace of gas to remain in the tube. This becomes ionized by collision with electrons and forms positive ions along the beam in such a manner that a concentrating field is set up. *See also* focusing.

gas laws Laws governing the variation of physical conditions (temperature, pressure, etc.) of a gas. *See* equations of state; ideal gas.

gas multiplication *Syn.* gas amplification. (1) The process by which, in a sufficiently strong electric field, ions produced in a gas by *ionizing radiation can produce additional ions. (2) The factor by which the initial ionization is multiplied as a result of this process.

gas-pressure cable A pressure cable employing an inert gas under pressure. It is a dry or oil-impregnated paper-insulated cable with a mechanically reinforced lead sheath, the contents of which are maintained at a high pressure by the introduction of nitrogen at about 1400 kPa (14 atmospheres) in contact with the insulating material. *Compare* compression cable.

gas scales of temperature Temperature scales in which changes in temperature are measured (1) by changes in pressure, (2) by changes in volume of a fixed mass of gas at constant volume or pressure respectively.

(1) The Celsius temperature t_v measured on the constant volume scale with a thermometer employing a particular gas is given by

$$t_v = \frac{p_t - p_0}{p_{100} - p_0} \times 100,$$

where p_t, p_{100} and p_0 are the pressures exerted by the given mass of gas when in equilibrium at the temperature t_v, the steam and ice point respectively, at the constant volume V_0.

(2) The Celsius temperature t_p measured on the constant pressure scale with a thermometer employing a particular gas is given by the equation

$$t_p = \frac{v_t - v_0}{v_{100} - v_0} \times 100,$$

where v_t, v_{100} and v_0 are the volumes occupied by the given mass of gas when in equilibrium at the temperature t_p, the steam and ice point respectively, at a constant pressure p_0.

Different gases give slightly different temperature scales when the initial pressure is finite, the same gas giving a different temperature on the two scales. When, however, the initial pressure tends to zero the scales given by different gases and different thermometers become identical and this extrapolated gas scale is chosen as the standard temperature scale. It is of course an ideal gas scale, for an ideal gas obeys Boyle's law, and for such a gas it may be seen that the constant-pressure and constant-volume scales are identical, and each agrees with the scale defined by

$$t' = \frac{(pV)_t - (pV)_0}{(pV)_{100} - (pV)_0} \times 100.$$

It is of course in the condition of the initial pressure tending to zero that an actual gas behaves as an ideal gas. Thermometers employing actual gases have to be corrected to give the temperature t' on the ideal gas scale. *See* constant volume and constant pressure gas thermometer.

Gassendi, Pierre (1592–1655), French philosopher and astronomer who revived the atomic theory of

APPENDIX 'D'

DEFINITIONS FOR THE FOLLOWING WORDS OR PHRASES (from J. Thewlis, Concise Dictionary of Physics (1973)):

1. **GLOW DISCHARGE. (Id. at 97).**

Concise Dictionary of Physics

J. THEWLIS DSc FInstP

J. THEWLIS DSc FInstP

After graduating with a first class honours degree in Physics at Manchester University, Dr. Thewlis went on to take an MSc degree by research in the laboratory of his Professor, the late Sir Lawrence Bragg. From there he moved to the National Physical Laboratory, where he was engaged in various research projects including the X-ray analysis of industrial materials and the determination of the sub-microscopic structure of teeth, and where he was awarded the degree of DSc of the University of Manchester.

During the war he joined the Ministry of Aircraft Production where he was involved in the early work on atomic energy, being later seconded to R.A.F. Bomber Command. Towards the end of the war, at the request of the U.K. Atomic Energy Project ("Tube Alloys"), he joined the Anglo-Canadian atomic energy team in Canada (Montreal and Chalk River), where he was in charge of scientific administration, being directly responsible to the late Sir John Cockcroft.

Returning to Britain after the war, during the early days of the Atomic Energy Research Establishment at Harwell, he set up a research branch dealing with the examination of atomic energy materials using a variety of specialized techniques. His laboratory was in fact the first outside the USA to use a nuclear reactor for neutron diffraction and the first in the world to use such a reactor for neutron radiography. It was while he was at Harwell that Dr. Thewlis was appointed Editor-in-Chief of the Pergamon nine volume Encyclopaedic Dictionary of Physics.

In addition to his considerable scientific experience, Dr. Thewlis is a Fellow of the Institute of Physics and of the former Physical Society. He is also a former member of the Board of the Institute of Physics and of the Dental Research Committee of the Medical Research Council. He is currently Chairman of a Committee of the British Standards Institution concerned with Terminology in Nuclear Science and Technology, and a member of a Committee of the International Standards Organization dealing with the same topic. He is also Honorary Secretary of the Physics-in-Industry Sub-Committee of the Institute of Physics and Vice-Chairman of the Institute's Scottish Branch.

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Title	**Concise dictionary of physics and related subjects, [by] J. Thewlis.**
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DISCHARGE, FIELD-INTENSIFIED. See: *Discharge, Townsend.*

DISCHARGE, GLOW. An electrical discharge between cold electrodes in low-pressure gas, characterized by its low current-density (about 10^{-6} to 10^{-1} A cm^{-2}) and occurring at a potential above the ionization potential and below the sparking potential. A series of characteristic regions appears in the discharge between the anode and the cathode and may be displayed in a specially constructed *glow discharge tube.* See also: *Anode dark space. Anode fall. Anode glow. Aston dark space. Cathode dark space. Cathode glow. Cathode layers. Faraday dark space. Negative glow. Positive column.*

DISCHARGE, HOLLOW CATHODE. An electrical discharge in which, by virtue of the hollow shape of the cathode, much higher currents can be sustained by the same voltage than for plane cathodes. The effect of a hollow cathode also occurs when two plane cathodes are brought sufficiently close together for the negative glows to interact. See also: *Hollow cathode.*

DISCHARGE, RING. A ring-shaped electrodeless discharge produced by the high-frequency oscillating electromagnetic field of an external coil. Also known as a *toroidal discharge.*

DISCHARGE, SELF-SUSTAINING. An electrical discharge in which the elementary particles carrying the current are created by the discharge itself; and which does not, therefore, require such adjuncts as irradiation or thermal emission. See also: *Discharge, Townsend.*

DISCHARGE, SPARK. An electrical discharge in which the current is carried by a spark, which constitutes a transient conducting ionized path between the electrodes. After a millisecond or more the characteristics may change to those of an arc.

DISCHARGE, STREAMER. An electrical discharge in which luminous lines ("streamers") occur. The streamers arise from avalanches produced along their length by ionization due to photons.

DISCHARGE, STRIATIONS IN. Streaks or lines occurring in an electrical discharge. Some are periodic in space and time, others in space only. They are produced when an alternating potential difference is applied but may also occur with a fixed potential.

DISCHARGE, SUBNORMAL. See: *Discharge, Townsend.*

DISCHARGE, TIME LAG OF. The time which elapses between the instant at which the voltage applied to a gap exceeds the minimum breakdown voltage of the gap and that at which spark breakdown occurs. It consists of two parts, the *statistical time lag*, namely the time required for a suitably placed electron to appear in the gap to initiate the spark once the breakdown voltage has been exceeded, and the *formative time lag*, namely the time required for the spark, once initiated, to develop across the gap.

DISCHARGE, TOROIDAL. See: *Discharge, ring.*

DISCHARGE, TOWNSEND. An electrical discharge with current density so small that the space charge is negligible, which is not self-sustaining, but requires the presence of an external source to maintain the necessary ionization. The current is amplified owing to ionization by collision. Also known as *field-intensified discharge* or *subnormal discharge.*

DISCHARGE, TRACKING OF. (1) An electrical discharge over the surface of a solid dielectric, caused by the passage of a leakage current in a contaminating layer. (2) The damage produced by such a discharge.

DISCHARGE TUBE. A tube containing gas at low pressure through which an electric current may be passed.

DISINTEGRATION ENERGY: Q-VALUE. For a given nuclear disintegration: the amount of energy released in that disintegration. A negative value signifies that energy is absorbed. See also: *Q: Q-value.*

DISINTEGRATION, NUCLEAR. The transformation of an atomic nucleus, possibly a compound one. It is characterized by the emission of one or more particles or photons, or the splitting of the nucleus into more nuclei.

DISK AREA. Of a system of rotating aerofoils: the area swept out by the tips of the blades.

DISK OF LEAST CONFUSION. Another term for circle of least confusion. See also: *Astigmatism.*

DISLOCATION. (1) A concept in the continuum theory of elasticity involving six types of relative displacement, known as dislocations. These displacements include rotations and pure translations. (2) A type of imperfection in a crystalline solid affecting the regular arrangement of the atoms. It involves displacements of a more restrictive nature than in (1) above in that translations are restricted to complete lattice vectors and rotations to full symmetry operations. An *edge dislocation* refers to a set of translations resulting in a line of lattice misfits (a *dislocation line*) which runs through the crystal in a direction at right angles to the direction

APPENDIX 'E'

DEFINITIONS AND ORIGIN OF USAGE FOR THE FOLLOWING WORDS OR PHRASES (from John Andrew Simpson and Edmund S. C. Weiner, The Oxford English Dictionary (2d. ed. 1989):

1. EVACUATE. (Id. at Volume V., p. 445).

THE OXFORD ENGLISH DICTIONARY

SECOND EDITION

Prepared by

J. A. SIMPSON *and* E. S. C. WEINER

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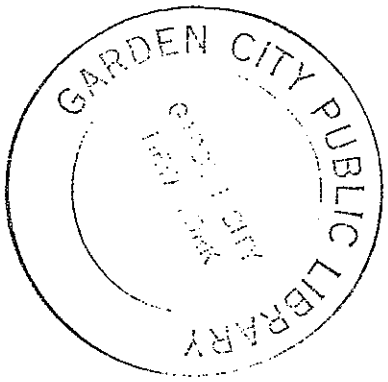

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glucuronic acid and euxanthone on hydrolysis; purreic acid.

1852 [see PURREE]. 1943 *Thorpe's Dict. Appl. Chem.* (ed. 4) VII. 424/2 Euxanthic acid is isolated by digesting piuri with dilute hydrochloric acid. 1959 E. H. RODD *Chem. Carbon Compounds* IV. viii. 966 Xanthen derivatives have long been known, and include euxanthic acid and the related euxanthone.

euxanthone (juːˈzænθəʊn). *Chem.* [ad. G. *euxanthon* (O. L. Erdmann 1844, in *Jrnl. f. Prakt. Chem.* XXXIII. 205), f. prec. + -ONE.] A yellow derivative of xanthone, $C_{13}H_8O_4$; purrenone; 1:7-dihydroxyxanthone.

1852, 1857 [see *s.v.* PURREE]. 1952 K. VENKATARAMAN *Chem. Synthetic Dyes* II. xxiv. 740 Euxanthone, found in the urine of cows fed on mango leaves, is 1:7-dihydroxyxanthone. 1959 [see prec.].

euxenite (ˈjuːksɪnaɪt). [f. Gr. *εὔξεν-ος* hospitable (f. εὖ- + *ξένος* stranger) + -ITE.

So named by Scheerer in 1840 (*Pogg. Ann.* L. 153) 'on account of the many rare constituents which it harbours'.] A mineral found in Norway, consisting mainly of niobate and titanate of yttrium.

1844 DANA *Min.* 436 Euxenite comes from Jölster in Norway. 1873 WATTS *Fownes' Chem.* 378 It [Thorium] has since been found in Euxenite.

euzeolite (juːˈziːəlaɪt). [f. EU- + ZEOLITE.] (See quots.)

1832 SHEPARD *Min.* 178 Heulandite..Euzeolite. 1868 DANA *Min.* 443 In 1817, Breithaupt separated the two zeolites, and called the latter euzeolite. In 1822 Brooke.. named the other heulandite.

evacate: a spurious word in Dicts; see EVOCATE.

evacuant (ɪˈvækjʊənt), *a.* and *sb.* [f. L. *evacuant-em*, pr. pple. of *ēvacuāre*: see EVACUATE.]

A. *adj. Med.* That evacuates or tends to evacuate; promoting evacuation, cathartic, purgative.

1800 *Med. Jrnl.* IV. 214 Evacuant and debilitating remedies. 1818 A. T. THOMSON *Lond. Disp.* II. 41 Their general operation is evacuant, either by the stomach, the bowels, or the skin. 1881 tr. *Trousseau & Pidoux' Treat. Therap.* I. 168 Evacuant treatment in general.

B. *sb.* 1. *Med.* A medicine that promotes evacuation; as a purgative, emetic, diaphoretic.

1730–6 in Bailey (folio). 1732 *Hist. Litt.* IV. 9 Those stupendous Effects which vegetable Concretes excite in the Body, both as Evacuants and Alterants. 1753 TORRIANO *Sore Throat* 32 The Emetic repeated did not act as an Evacuant in the least. 1830 LINDLEY *Nat. Syst. Bot.* 73 Asarabacca is used by native practitioners in India as a powerful evacuant. 1876 BARTHOLOW *Mat. Med.* (1879) 2 To the class of evacuants belong emetics..and diuretics.

2. In *Organ-building*, a valve to let out the air from the bellows.

evacuate (ɪˈvækjʊeɪt), *v.* Also 6–7 evacuat. *Pa. pple.* 6–7 evacuat(e. [f. L. *ēvacuāt-* ppl. stem of *evacua-re* (Pliny), f. *ē* out + *vacuus* empty. Cf. F. *évacuer*.

In class. L. *evacuāre* is found only in Pliny, with the sense 'to empty (the bowels)'. The Vulgate and later law-books have the fig. sense 'to make void, nullify', which is rather to be regarded as parallel with the older sense than as developed from it, being based on the fig. sense of *vacuus* 'void, null, of no validity'. The sense represented in branch II, where the obj. is the contents instead of the vessel or receptacle, is a development similar to that in *to empty*, Fr. *évacuer*, occurs in med.L. in medical use (*evacuare humores*, etc.) and hence in Fr. *évacuer*.]

I. To make empty.

To remove the contents of.

†1. *trans.* To empty, clear out the contents of (a vessel or receptacle). Chiefly in uses more or less technical: To empty (the stomach, bowels, or other bodily organ); to deplete (the body) by purging or vomiting (formerly also by bleeding, sudorifics, etc.); to exhaust (of air).

1541 BOORDE *Dyetary* viii. 248 After you haue euacuated your body, and trussed your poyntes, kayme your heade oft. 1600 HOLLAND *Pliny* XXXII. ix. 443 The broth of these fishes is of the name to evacuat both the bellie and the bladder. 1644 HAMMOND *Loyal Convert* 13 Physicians evacuate the body sometimes by Vomit, sometimes by Purge. *a* 1652 BP. HALL *Cases Cons. Wife* III. ii, I will prefer thee to..make my Bed and evacuate my Chamberpot. 1660 BOYLE *New Exp. Phys. Mech.* To Rdr. (1682) 5 Evacuate such Receivers till there be no air left in them. 1710 STEELE *Tatler* No. 99 ¶3 He had detached all his Subjects and evacuated all his Stores. 1748 HARTLEY *Observ. Man* I. ii. 215 The Contraction of the Peristaltic Glands, whereby they are evacuated. 1875 *Seaman's Pocket Bk.* viii. (ed. 2) 305 In all cases of poisoning the first step is to give the antidote..and then evacuate the stomach. 1883 *Standard* 31 Jan. 5/4 It is impossible to evacuate them by cutting trenches through which the black ooze drains.

absol. (In quot. †to let blood.)

1621 BURTON *Anat. Mel.* II. v. II, If the malady continue, 'tis fit to evacuate in a part in the fore-head.

2. *trans.* To deprive (a term, concept, etc.) *of* its value. Cf. 4.

1604 HOOKER *Eccl. Pol.* IV. x. (1611) 147 By euacuating and emptying the church of euery such rite and ceremonie. 1633 S. WARD in Spurgeon *Treas. Dav.* Ps. xiii. 5 Hath it [faith] not sovereign virtue in it, to..evacuate the mind of all ill thoughts and passions. *a* 1734 NORTH *Lives* I. 8, I hope to evacuate my mind of every matter and thing I know..concerning his lordship. 1825 COLERIDGE *Aids Refl.* (1836) 150 They..evacuate the term [spirit] of all its proper meaning. 1836–7 SIR W. HAMILTON *Metaph.* xxxix. (1870) II. 384 Brown..evacuates the phænomenon of all that desiderates explanation. 1862 MERIVALE *Rom. Emp.* (1865) III. xii. 15 They sank into exhaustion, evacuated of all life and energy. 1869 HADDAN *Apost. Succ.* i. (1879) 15 To evacuate the sacraments of grace, and to regard them as merely acted prayers.

†d. *refl.* and *intr.* for *refl.* Of a body of water, etc.: To empty, discharge itself. Also *fig. Obs.*

1725 DE FOE *Voy. round World* (1840) 311 At the further end of the lake, they found that it evacuated itself into a large river. 1762 STERNE *Tr. Shandy* V. iii. 23 Such griefs evacuate themselves best by that particular channel. 1817 KEATINGE *Trav.* II. 265 Where the canal evacuates is placed a net to catch what would pass off and be lost.

†2. To clear (a place) of inmates, etc., (a country) of inhabitants, troops, wild beasts. Const. *of.*

1607 TOPSELL *Four-f. Beasts* (1673) 136 That the whole countrey might be evacuated and quite cleared from wolves. 1687 in *Magd. Coll.* (Oxf. Hist. Soc.) 81 To evacuate a whole College will be..scandalous. 1704 *Addr. Norfolk* in *Lond. Gaz.* No. 4068/2 A Great Monarch..evacuates whole Countries. 1708 *Ibid.* No. 4462/2 Evacuating the Kingdom of all Foreign Troops. 1751 JOHNSON *Rambler* No. 171 ¶14 In France they annually evacuate their streets, and ship their prostitutes and vagabonds to their colonies. 1753 SMOLLETT *Ct. Fathom* (1784) 34/1 Her room was no sooner evacuated of such troublesome visitants, than [etc.].

3. a. Of an army; To relinquish the occupation of (a country, fortress, town, position). Said also of the general in command, or of the authority that orders the withdrawal.

1710 STEELE *Tatler* No. 76 ¶5 The Army..had begun to repass the Mountains, and would shortly evacuate Savoy. *a* 1745 SWIFT (J.), The emperour..never effectually evacuated Catalonia. 1792 *Anecd. W. Pitt* III. xxxix. 35 The French forces who had invaded and seized Turks Island must immediately evacuate the same. 1840 MACAULAY *Clive* 21 The garrison, in a panic, evacuated the fort. 1863 KINGLAKE *Crimea* I. xxv. 433 She [Austria] summoned the Emperor Nicholas to evacuate the Principalities. 1887 *Spectator* 28 May 722/1 Egypt is to be evacuated within three years.

absol. 1881 DILLON in *Times* 5 Jan. 10/1 As soon as the army evacuates he can go back to his own home.

b. *gen.* To quit, withdraw from (a place or apartment). Also *absol.*

1809 W. IRVING *Knickerb.* (1861) 271 The burgomasters were not slow in evacuating the premises. 1830 GALT *Lawrie T.* VII. viii. (1849) 337 The other guests had evacuated the apartment. 1849 C. BRONTË *Shirley* XV. 226 Request your friend Mr. Donne to evacuate. 1877 FARRAR *My Youth* XXX. 303, I will evacuate it whenever you like.

*** To make void or worthless.*

†4. To make void, annul, deprive of force or validity. Chiefly in religious and legal phraseology. (The earliest recorded sense in Eng.) *Obs.*

1526 *Pilgr. Perf.* (W. de W. 1531) 5 Ceremonyes..whiche all were euacuate and made voyde by the passyon of our sauyour Jesu Chryst. 1548 LATIMER *Ploughers* (Arb.) 32 Thys is the marke at the whyche the Deuyll shooteth, to evacuate the crosse of Chryste. 1563 DAVIDSON *Answ. Kennedy* in *Wodr. Soc. Misc.* 257 To have evacuat the Reasonis of 3our Buik. 1622 BACON *Hen. VII*, 81 Which defect..would not euacuate a Marriage after Cohabitation and Actual Consummation. *a* 1626 BP. ANDREWES *Serm.* (1856) I. 83 We evacuate the gift..if we vouchsafe not to accept of it. 1638 CHILLINGW. *Relig. Prot.* iv. § 45. 213 Words, which evacuate your objection. 1709 STRYPE *Ann. Ref.* I. ii. 62 Of which lands they had been thrown out in Queen Mary's reign, and their patents from king Edward evacuated. 1785 PALEY *Mor. Philos.* (1818) I. 141 A latitude, which might evacuate the force of almost all promises.

II. To empty out (the contents of anything).

†5. Of the action of a medicine, vomiting, etc. (rarely of a personal agent by means of medicine): To clear out, get rid of, remove (a disease or humour). Also *fig. Obs.* Cf. 1.

1533 ELYOT *Cast. Helthe* III. vii, Vnctions with oyles and oyntementes..do shortely euacuate the fulnesse. 1601 HOLLAND *Pliny* XXV. v. 217 The white [Ellebore purgeth] by vomit upward, and doth evacuat the offensive humours which cause diseases. 1671 SALMON *Syn. Med.* II. xlvi, 314 A perfect Crisis is that which evacuates all the vitious Matter. 1715 I. PETIVER in *Phil. Trans.* XXIX. 230 The Seed of this Plant evacuates yellow Choler. *a* 1716 SOUTH *Serm.* ix. 341 (T.) Fasting and humiliation is a sovereign remedy to evacuate all spiritual distempers. 1779 JOHNSON *L.P., Pope* Wks. IV. 85 Thomson declared his [Pope's] distemper to be a dropsy, and evacuated part of the water by tincture of jalap. 1790 W. BUCHAN *Dom. Med.* (ed. 11) 553 The principal intention..is to evacuate the offending matter.

6. a. To void, discharge (excrements, etc.) through 'any of the excretory passages' (J.); in mod. use only through the bowels or mouth.

1607 TOPSELL *Four-f. Beasts* (1673) 322 That part..will grow unto a head and break, evacuating great abundance of filthy matter. 1664 POWER *Exp. Philos.* I. 37 That round hole near her [Black Snail's] neck..out of which I have observed some salivous Matter to be evacuated. 1766 ALEXANDER in *Phil. Trans.* LVII. 68, I started up..made some efforts to vomit, but evacuated nothing. 1800 *Med. Jrnl.* IV. 386 About four pints of urine had been evacuated. 1865 BARING-GOULD *Werewolves* x. 173 He evacuated such floods of water that the mountain torrents were full.

absol. 1634 J. LEVETT *Ordering of Bees* 59 They haue no Intraylls or other inward Organs, by which either to retaine or evacuat. 1666 G. HARVEY *Morb. Angl.* (1672) 104 A man that doth feed upon one dish at a meal shall nothing near evacuate..so quick or readily as one that dines upon two or more. 1705 OLIVER in *Phil. Trans.* XXV. 2178 But no body ever saw him Eat or Evacuate.

b. In wider sense (partly *transf.* from the above): To discharge, throw off, vent. Also *fig.*

1622 HAWKINS *Voy. S. Sea* (1847) 146 Their houses are made..with a laver in the toppe to evacuate the smoake when they make fire. 1662 GERBIER *Princ.* 20 The Lime having evacuated its putrefaction. 1816 J. SCOTT *Vis. Paris* (ed. 5) 19 When a Margate hoy evacuates her cargo, the crowd on the pier is usually considerable. 1841 *Fraser's Mag.* XXIII. 511 Judging from sentiments which he has evacuated in some of his public spoutifications.

†7. a. To take out mechanically, leaving a vacuum or void; to pump out (water); to exhaust (air). Also *fig. Obs.* exc. in surgical use.

1719 DE FOE *Crusoe* II. i, Any one would have thought that the native Propensity to rambling..should be worn out, the volatile Part be fully evacuated. 1751 SMOLLETT *Per. Pic.* (1779) I. xiii. 115 The contents of his skull must have been evacuated. 1767 GOOCH *Treat. Wounds* I. 295 As much of the brain was evacuated, as wou'd fill a hen's eggshell. 1772 HUTTON *Bridges* 82 The water will ooze up..in too great abundance to be evacuated by the engines. 1781 COWPER *Lett.* 5 Mar., As much of the mould as can be taken out without disturbing the roots must be evacuated and its place supplied with fresh. 1794 G. ADAMS *Nat. & Exp. Philos.* I. iv. 137 The ascent of the quicksilver..is proportional to the quantity evacuated by each turn. 1797 M. BAILLIE *Morb. Anat.* (1807) 112 If..the pus be evacuated externally, there will be a scar in the neck. 1877 tr. *Ziemssen's Cycl. Med.* XII. 704 The contents of abscesses have been evacuated in the following directions.

b. *intr.* for *refl.*

1643 R. O. *Man's Mort.* iii. 13 A Vessell..so solilid every where, that the Aire could not possibly evacuate. 1707 *Curios. in Husb. & Gard.* 261 The Sap..turns aside and evacuates by this Aperture.

8. a. To clear out, remove (inhabitants, inmates, or troops). †Also *intr.* for *refl.* Cf. 2.

a 1639 WOTTON in Gutch *Coll. Cur.* I. 220 Action had pretty well evacuated the idle people, which are the stock of rapine. 1669 CHILD *Disc. Trade* (ed. 4) 233 The people that evacuate from us to Barbadoes. 1691 BEVERLEY *Thous. Years Kingd. Christ* 23 Nor can he cease to Reign, till They [his enemies] are so Evacuated. 1698 LUDLOW *Mem.* (1721) I. 179 The Garrison would be entirely evacuated before they could signify their Pleasure to the Army. 1872 *Daily News* 3 May 5/6 The wounded used to be stowed in it [the refreshment room at Meaux] till the time came conveniently to evacuate them. 1884 *Ibid.* 5 Mar. 5/7 He was evacuating the garrison and Egyptian inhabitants of that place [Tokar].

b. *spec.* To remove (inhabitants of an area liable to aerial bombing or other hazards) to safer surroundings. Also *transf.*

1938 *Times* 28 Oct. 15/2 Authorities of our large towns will wonder whether or not to evacuate more than children. 1940 *Ann. Reg. 1939* 87 Mr. Greenwood and others strongly appealed to the Prime Minister to evacuate children at once. 1941 *Essays & Studies* XXVI. 61 This statement it has proved impossible to check, as the Burney newspapers are evacuated and the journal is not at Bodley.

evacuated (ɪˈvækjʊeɪtɪd), *ppl. a.* [f. prec. + -ED¹.] In the various senses of the vb.

1684 R. WALLER *Nat. Exper.* 63 He [Boyle] mentions a Larks living in the Evacuated Receiver..about ten Minutes. 1762 CANTON in *Phil. Trans.* LII. 461 Within an evacuated glass ball. 1773 HORSLEY *ibid.* LXIV. 236 Columns of water, sustained in evacuated tubes of sufficient length. 1822 J. FLINT *Lett. Amer.* 236, I took this opportunity of reconnoitring the evacuated field. 1939 *Times* 28 Oct. 7/2 Parents of evacuated children should contribute to their maintenance. 1942 E. WAUGH *Put out more Flags* ii. 144, I am the district billeting officer. I'm looking for a suitable home for three evacuated children.

evacuating (ɪˈvækjʊeɪtɪŋ), *vbl. sb.* [f. as prec. + -ING¹.] In senses of the verb. Also *attrib.*

1594 PLAT *Jewell-ho.* I. 27 The euacuating thereof [the vaine of earth]. 1642 J. EATON *Honey-c. Free Justif.* 40 To the abolishing, evacuating, or utter vanishing away of sinne. 1660 BOYLE *New Exp. Phys. Mech.* xxiv. 188 Upon the evacuating of the Receiver. 1753 TORRIANO *Sore Throat* Pref. 15 For one Patient..that dies by this Method, five will die by the evacuating Method. 1875 W. HOUGHTON *Sk. Brit. Insects* 18 The evacuating ducts are constant.

evacuation (ɪˌvækjʊˈeɪʃən). [ad. late L. *ēvacuātiōn-em*, n. of action f. *ēvacuā-re*: see EVACUATE.] The action of evacuating; the condition of being evacuated.

1. *spec.* a. *Med.* The action or process of depleting (the body or any organ), or of clearing out (morbid matter, 'humours', etc.), by medicine or other artificial means. *rare* in recent use.

Before the present century the word was most frequently used with reference to bleeding; for this we have a large number of quotations.

c 1400 *Lanfranc's Cirurg.* (MS. A.) 100 Ofte tymes he hap..to myche evacuacioun of blood. 1533 ELYOT *Cast. Helthe* (1541) 53a, To expell the sayd excrementes are ix sundry kyndes of evacuation..abstinence, vomyte, purgation by siege, letting of bloude, etc. 1603 HOLLAND *Plutarch's Mor.* 1317 Evacuation, or clensing the body by clistre. 1621 BURTON *Anat. Mel.* II. v. II. (1651) 398 Bleed on..If the parties strength will not admit much evacuation in this kinde at once, it [bleeding] must be assayed again and again. 1651 BIGGS *New Disp* 136 One manner of evacuation of evil humours, purgation. 1748 SMOLLETT *Rod. Rand.* XXXV. (1804) 229, I prepared for this important evacuation [of blood]. 1790 W. BUCHAN *Dom. Med.* (ed. 11) 217 The patient exhausted by mere evacuations, sunk under the disease. 1805 W. SAUNDERS *Min. Waters* 467 This method